# USING MUSICAL STRUCTURES TO COMMUNICATE EMOTION

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# Plagiarism Declaration

This work has not been previously submitted in whole, or in part, for the award of any degree. It is my own work. Each significant contribution to, and quotation in, this dissertation from the work, or works, of other people has been attributed, and has been cited and referenced.

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# Abstract

**Keywords:** Musical structures, emotion, valence x arousal diagram, expression of emotion, perception of emotion, induction of emotion, musical expectation, musical syntax, tempo, rhythm, timing patterns, loudness, dynamics, mode, harmony, melody, dissonance.

This study investigates the hypothesis that music has the ability to strongly influence emotions in listeners. It begins by challenging the accuracy of this presumption, provides a general psychological and philosophical overview of human emotions and their relation to music, and hypothesises a theory that accounts for the numerous different findings by authors around this topic. The study then attempts to investigate in what manner specific musical structures are linked to the expression of certain emotions; firstly through a literature review and secondly through the execution of empirical tests. These findings are summarised in the Conclusion. An Annexure to this study provides graphic representations of specific musical structures on valence x arousal diagrams that are of value to composers of music.

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# CHAPTER ONE

# INTRODUCTION

## *MUSIC AS A TOOL FOR EMOTIONAL EXPRESSION*

> *Of all the arts, music is the most sublime, and touches the heart of every human being. Even those rare ones who boast that they are tone deaf have, at some time in their lives, been moved by music of one sort or another (Martin, 1983:8).*

Throughout history, in different cultures worldwide, music has been an integral part of human lifestyle (Thompson *et al.*, 2005; Livingstone & Thompson, 2006). It is widely believed that one of the primary functions of music is to both express emotions and to induce emotions in listeners. This would explain the attraction of music for humans. (Madison, 2008). Music is thus regarded as a medium of emotional communication, and is often regarded as a better communicator of subtle emotion than language (Mennhin & Davis, 1980; Vischer, 1987; Levetin, 2006; Madison, 2008; Zacharopoulou & Kyriakidou, 2009; Juslin, 2009; Rosen, 2010).

Music represents many facets of the human psyche. It is sometimes represented in the physical, through dance, facial expressions and gestures (Gabrielsson & Juslin, 1996). Music may represent movements – leaps, runs, or a static state (Gabrielsson & Lindström, 2010), and can therefore mimic human character, as in Peter and the Wolf where different musical themes resemble certain qualities of the different characters, for example the upbeat, adventurous and slightly quirky main theme that announces Peter. Music can resemble announcements like questions, statements, or answers (Pease, 2003; Gabrielsson & Lindström, 2010). It is therefore not strange that during the periods of Baroque and Classical music, it was the norm to name a piece of music after the character of the music: for instance *vivace* describing a lively quality, or *andante* referring to the steady beat of a stroll (Cloete, 2008). Music calls up images in the mind of the listener, for example, that of a river, and lastly expresses moods and emotions (Gabrielsson & Lindström, 2010). It is the aspects of mood and emotion with which this dissertation is mostly concerned.

Many modern day applications of music assume that it is effective in evoking emotions (Juslin, 2009). Commercially, music is an integral part of film, advertising and marketing, and is also used as a device to condition general client mood in commercial environments such

as restaurants or clubs (North & Hargreaves, 2010). These practices are connected to multi-billion dollar international industries (Cohen, 2001; Plantinga, 2009).

With easy access to music in contemporary life, people often use music as a tool to attempt to influence or control their own emotions (Rozin & Rozin, 2008). According to Brown (2009), they do this in several ways: they attempt to change their current emotion by listening to music that expresses their desired emotion, normally to create good feelings and pleasant moods (allopathic mood control), or they deal with emotions by matching – thus amplifying – their current emotion (homeopathic mood control). Through the amplification of an experienced emotion, a person can be assisted to deal with a certain situation, such as a negative event that must be reflected upon. For this reason, even sad music usually has a positive effect on a listener (Madison, 2008). On the other end of the spectrum, music can help someone to make the most of a joyful moment. Music is further used to channel stress, or to comfort the listener (Juslin & Västfjäll, 2008; Brown, 2009).

It may thus be concluded that music does indeed have the ability to influence and communicate emotion (Meyer, 1956), hence Konečni's statement: "One can see how the attributes of constant presence, diffuseness, subtlety, and diversity would make *mood* a natural partner for music…" (2010:712). *emphasis mine*)

However, this raises an important question as to *how* music communicates and influences emotion (Scherer, 2004).

Music is experienced in various aspects of human perceptive and physical states and for this reason different scientific fields have taken an interest in the effects of music (Thompson *et al.*, 2005). Researchers from the fields of philosophy, neuroscience, psychology and musicology have investigated this phenomenon (Juslin & Sloboda, 2010; Vickhoff & Malmgren, 2004; Levetin, 2006; Juslin & Lindström, 2010). The multi-facetted nature of the fields of research in musical emotion is due to the many integrated components that are involved. It may, according Konečni (2010), begin with the composer (a person who, in a certain context, is creatively trying to express emotion), the composition (the musical structure), the performance (including the nuances of the performer, the instruments used, and the venue or setting of the performance) as well as the listener (a cognitive and

emotional being with individual background, preference and emotional state at the moment of the performance).

The effect of music on emotion seemingly received little attention before the 1990s, but an increase in interest in the relationship between music and emotion has resulted in many publications during the last one and a half decades (Zacharopoulou & Kyriakidou, 2009). However, many questions as to how music expresses emotional content and why music is so powerfully able to achieve this, are not yet answered (Jeans, 1968; Scherer, 2004; Vieillard *et al.*, 2008; Juslin, 2009). Factors hampering progress in research are due to inconsistent methodological approaches and a lack of consistent theoretical frameworks (Zacharopoulou & Kyriakidou, 2009; Scherer 2004). Music is not always primarily about emotion, making its uses possible in many different contexts (Livingstone & Thompson, 2006), and so confusion around the relationship of music and emotion is exacerbated.

This proposed dissertation is however specifically concerned with the *musical* aspects that have an influence on emotion. It seems that fewer researchers have investigated this field from a musicological perspective and so this research has an important contribution to make.

*OUTLINE OF THIS STUDY*

This dissertation will investigate how musical structures can stimulate certain emotional responses in listeners. In order to reach this aim, the following sub-aims are provided:

a) Methods of emotional classification will be discussed and thereafter an explanation of the foundational psychological, physiological and neurological mechanisms of emotional communication through music will be presented.
b) Existing musicological principles regarding the use of musical structures to communicate emotion through music will be established through a literature study.
c) Some deficiencies in available information regarding the role of specific musical structures in the communication of emotion through music will be researched using empirical tests.
d) The findings from literature reviews as well as conclusions reached by the empirical tests conducted will be presented in summary form.

The musicological background for the purposes of this study should be seen in the light of music experienced within contemporary popular culture. This implies that some conventions such as atonal music, bebop jazz and cultural specific music are not taken into account. However, some literature used in this study is written from the background of Western art music, but finds its relevence in that Western art music has laid an important part of the foundation on which popular music is based.

# CHAPTER TWO

## MUSIC AND EMOTION: CLASSIFICATIONS AND INTERACTIONS

The term "emotion" is related to other terms which are all briefly explained for the sake of clarity.

a) The broad term covering all evaluative states such as emotion, mood and preference, is "affect" (Juslin & Västfjäll, 2008). It is mostly assumed that a person is always in some sort of affective state (Juslin, 2009; Juslin & Sloboda, 2010).

b) Emotions are strong affective states, "departures from the normal state of relative composure" (Plantinga, 2009:54); states of tension (Bennett, 1942). They are influenced by needs, motivations, relational bonds and attitudes (Vickhoff & Malmgren, 2004). An emotion has a reason and therefore has a prominent cause (Juslin, 2009). The cause is termed the "object" of the emotion (Brown 2009). Emotions are subjective feelings. They are normally synchronised with physiological arousal that may result in bodily reactions like gestures and facial expressions (Livingstone & Thompson, 2006). They are tied to our cognition and tendency to act, and help us to make decisions (Plantinga, 2009). An emotion lasts for a relatively short amount of time (Vischer, 1987) – a few minutes up to a few hours at most (Juslin & Västfjäll, 2008; Juslin & Sloboda, 2010).

c) Moods are the same states as emotions, except that they are less intense and their causes are less obvious (Juslin, 2009; Brown, 2009; Juslin & Sloboda, 2010). They generally last longer than emotions, up to several days (Juslin & Västfjäll, 2008). However, the term is sometimes used to cover all conscious aspects of a person's inner state (Konečni, 2010). Moods correspond to valence (Husain *et al.*, 2002).

d) Feelings describe the individual's subjective experience of an emotion (Juslin & Västfjäll, 2008, Juslin & Sloboda, 2010).

It is important to note that, in many research articles, the word "emotion" is often wrongly used to also cover the related terms of mood and feeling (Juslin 2009).

## *CLASSIFICATION OF EMOTION*

There are different approaches regarding the classification of emotions, especially those emotions that are related to music.

### *Basic Versus Complex Emotions*

Emotions are categorised as Basic or Complex (Scherer, 2004).

Basic Emotions – the Darwinian Basic Emotions Theory being an example (Darwin, 1872) – are seen as separate entities, i.e. a person having a strong affective experience will be said to be experiencing a specific emotion, like being joyful or angry for example.

Brown (2009) states that basic emotion theories strongly underestimate the richness of human emotions and conversely support a theory of complex emotions. The complex emotion theory states that the basic emotions have nuances and deviations, that basic emotions can be combined to form complex emotions, and that they are made up of different degrees of intensity and positivity/negativity (Husain *et al.*, 2002; Schubert, 2010). The complex emotion theory thus views emotions almost like different shades of colours. Meyer (1956) notes that even the names we attach to emotions are not sufficient to explain the diverse reactions that take place in the inner person. Many researchers strongly believe that music can induce these complex emotions and related affective states (Juslin, & Västfjäll, 2008; Bharucha & Curtis, 2008; Juslin, 2009).

When emotions are portrayed in music, some intended emotions often share many structural similarities, and are hard to distinguish, for example 'tenderness' and 'sadness' (Gabrielsson & Juslin, 1996). So, to a certain extent, interpretation of the expressive character of music is open to interpretation resulting in an ambiguity as to the *exact* intended expression (Kessler & Puhl, 2004). Some authors (such as Kessler & Puhl, 2004) are of the opinion that *some* basic structural cues are reliable discerners of intended expression, while Zacharopoulou & Kyriakidou (2009) established through tests that different cultures within "the West" do seem to rely on *different* structural cues in order to interpret the expressive character of the music.

However, music can arouse more than emotions. It can evoke complex mental pictures, kinaesthetic images like that of floating and conceptual imagination, for example death

(Thompson & Coltheart, 2008). Music is strongly tied to other communicational devices like language and facial expressions (Levetin, 2006). It can generate empathy, influence motivational responses, stimulate reward circuitry and even give rise to responses in heart rate and breathing (Alcorta *et al.*, 2008). Listening to music stimulates more brain regions than many other daily activities (Levetin, 2006).

### *Other Classifications of Emotion*

If music can evoke complicated sets of emotions, and if music can evoke emotions better than language (Rosen, 2010), it seems obvious that music will evoke emotions that would be very difficult to describe in words and therefore descriptions would often be misleading (Meyer, 1956). Some researchers have indeed been using alternative terms to evaluate music-related emotions: Konečni (2008) prefers the terms "*being-moved"* or "*being-touched"* to describe these complicated musical emotional experiences, since these are measurable states. Descriptions like "warm" (Bharucha & Curtis, 2008) "opposing themes," "atmosphere," "movement/activity," "conflict," "dramatic interpretation" (Frances, 1988), "colour," "season," and "temperature" (Schoen, 1927) have been used. Scherer (2004) suggests that new methods of examining complex emotions should be devised. After conducting various field studies, Scherer & Zentner (2008) divided musical emotions into nine groups, namely: "wonder, transcendence, tenderness, peacefulness, nostalgia, power, joyful entrainment, tension, and sadness" (2008:596). Scherer and Zentner's approach is helpful in that they try to group complex emotions into more basic and accessible categories.

It should be considered whether the emotions experienced through music are the same as emotions experienced in other realms of life. As mentioned previously, emotion has an object, while music is not necessarily *about something*, implying that music may certainly evoke emotions different from those experienced in daily life. This will necessitate new classifications of emotions that are applicable to music.

Levetin (2006) and Juslin (2009) argue that the *same* emotions experienced in everyday life can be evoked through music, though the emotions we experience when listening to music are not happening under the same circumstances as everyday emotions. Thus, a musical experience of a certain emotion may be different from the everyday one (Zentner & Eerola,

2010). Krumhansl & Agres (2008), Bharucha & Curtis, (2008) as well as Scherer & Zentner (2008) agree that, because musical emotions are different and often more complex than everyday emotions, it is not possible to use the standard emotional classification framework as used for general psychological studies. Patel (2008) goes as far as to suggest that emotional experiences through music are totally unique. In response, Scherer and Zentner (2001) propose that many everyday emotions are utilitarian and have the function of guiding our decisions. These are therefore linked to cognitive appraisal, meaning that we experience an emotion based on an outcome of an event, or a goal reached or blocked (Juslin & Västfjäll, 2008).

If emotion is defined as having an object (Brown, 2009), what is then the object of an emotion induced through music? Both Meyer (1956) and Scherer and Zentner (2008) reason that the object of music is an *aesthetic* object. This confirms the view that music can trigger an emotion, not merely a mood. However, we respond differently to an aesthetic object; we do not *actively* respond to it. In a concert situation (especially in a classical music setting), we do not necessarily laugh or dance along with jolly music, or cry along with sad music. Sometimes we inhibit the tendency to act in the manner in which we might in a real-life situation. This inhibited action triggers a different type of emotional response – aesthetic emotions which are not connected to a material outcome. (Meyer, 1956). They are normally not experienced based on the reaching or blocking of a tangible goal.

These aesthetic emotions are explained as the evoking of pleasant responses in the perceiver upon appreciating the artwork, and are the most common types of emotion induced by music. The aesthetic emotion stems indirectly from the expression of emotion in a musical artefact, but is not necessarily the same as the expressed emotion. Examples of the presence of aesthetic emotions are feelings of awe, transcendence or longing, and chills, tears or "being moved" (Brown, 2009).

Still, aesthetic emotions are not clearly defined, hence Scherer and Zentner's (2001) reluctance to tag characteristics to this classification. The best summaries of aesthetic emotions have to do with descriptions of beauty: "Music represents beauty by *being* beautiful" (Brown, 2009). And, "finally, we should not forget that many people enjoy music simply for its expression of beauty" (Gabrielsson, 2009:148).

Rosen (2010) further explains the difference in sentiment between an everyday emotion, and the emotion experienced while listening to a sad-sounding piece of music. The sad emotion is only *represented* in the music, and because we understand the context, we can enjoy the music. Our admiration for the music distances us from the emotion being expressed by the music (Rozin & Rozin, 2008). The music becomes a symbol of something, and the symbol separates us from the present reality (Vickhoff & Malmgren, 2004). We are removed from the "threat" posed by fearful music, for example, and so sad or fearful music less often induces real fear or sadness in the listener than happy music (Zentner & Eerola, 2010). The following quote by Arthur Schopenhauer provides an interesting perspective:

> The inexpressible depth of all music, by virtue of which it floats past us all as a paradise quite familiar and yet eternally remote, and is so easy to understand and yet so inexplicable, is due to the fact that it reproduces all the emotions of our innermost being, but entirely without reality and remote from its pain" (Arthur Schopenhauer, 1818 cited by Oelmann & Laeng, 2009:1).

Because music is a moving, dynamic force, it can be difficult to attach a single emotional description to a piece of music. However, the notion of *vitality affects* (Stern, 1993) provides an extremely useful classification: vitality affects represents the movement, or gradual change, of an emotion, for example "joyful" slowly transforming into "exuberant." Vitality affects therefore captures the essence brought about by the fine nuances of complex emotions and the dynamic changes that can occur within a single emotional experience.

Levetin believes strongly that music, through its representations, dynamically reflects our emotional and moral lives, and our interpersonal relationships. These human factors are represented by the rising and falling, swelling and contracting, reacting, pausing and reflection of music (Levetin, 2006). Rosen (2010) agrees with this dynamism. He states that, like a sentence, a musical motif can have different meanings upon repetition, depending on the context. Consider Vischer and Robinson's perspectives on the reflection of musical structure on this mentioned dynamic representation of human life:

> The course run by a mood – how it unfolds making use of qualitative elements of arousal – will reflect the laws of development and movement governing all life: a rising and falling, tensing and releasing, a bonding together of related things, the drawing up and reconciling of strong and slight contrasts, splitting off into different currents, tapping of new sources, composing oneself again, finally returning satisfied to oneself, and exhaling (Vischer, 1987:145).

> When the listener is *surprised* by a move away from the tonic, *bewildered* when the music moves into key areas ever more distant from the tonic, and *delighted* when the tonic at last returns, these musical developments are the *intentional objects* of the emotions aroused (Robinson, 2008:593).

However, when listening to a piece of music, the emotions experienced can be of a totally different nature, irrespective of the emotion expressed by the music. We can be annoyed by the setting where the music is being played, be excitedly in awe of the interpretation of the performer, or be joyous of the experience of the music (Rozin & Rozin, 2008).

It can be concluded that we experience the same emotions as in everyday life, but because we are removed from the real object of the emotion, our experience of those emotions are different from those in real life (see Meyer, 1956).

### *Valence and Arousal*

An often used method for classifying emotions is the "Valence x Arousal Model" (Hunter & Schellenberg, 2010) [see Fig. 1]. It is represented as a two-dimensional graph. The X-axis indicates Valence, and the Y-axis resembles the Arousal factor.

Valence is the good (positive) or bad (negative) aspect of an affect (Brown, 2009), i.e. the measure in which a person likes or dislikes something. Arousal is a degree of response, referring to the amount of physiological and/or psychological activation involved. Arousal is thus the intensity of an emotion (Brown, 2009; Juslin & Sloboda, 2010). Adjectives describing arousal usually refer to physical states. While valence is a binary concept, being either good or bad, arousal is a graded component ranging from zero to maximum activation (Brown, 2009). This model helps to categorise complex emotions because it is possible to place complex emotions on the graph according to their degrees of valence and arousal and to establish their position in relation to established basic emotions. The model also accounts for the different degrees and intensities of emotions (Schubert, 2010).

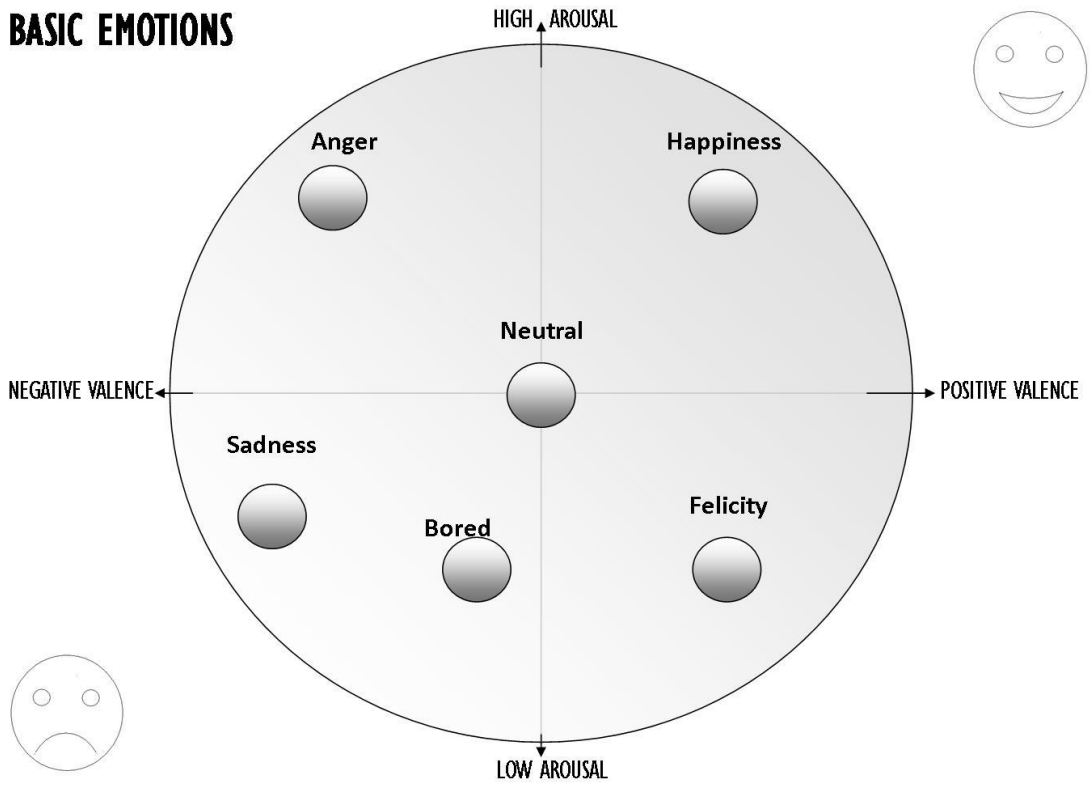


*Fig. 1. A representation of the Valence x Arousal diagram, with basic emotions presented. Adapted from Pittermann & Pittermann (2006).*

Emotions can therefore be classified according to positive valence and high arousal (e.g. happiness, joy, excitement), positive valence with low arousal (e.g. peace, contentment, relaxation), negative valence and low arousal (e.g. depression, sadness, boredom) or negative valence with high arousal (e.g. distress, fear, anger) (Hunter & Schellenberg, 2010).

One study reported that people could reliably distinguish music in terms of valence and arousal (Brown, 2009; Vieillard *et al.* 2011). Although this model can help us to group most emotions, the musical experience can instil mixed emotions. One shortcoming of the Valence x Arousal Model is that mixed emotions cannot be classified on it (Bharucha & Curtis, 2008; Hunter & Schellenberg, 2010).

The placement of the emotions within the Valence x Arousal model is not exact; there is a lack of consistency regarding the placement of emotions in exact parts of the Valence x Arousal plane in existing literature, and sometimes inconsistency in the placement of emotions within a certain quadrant. Furthermore, specific emotions can be experienced at different levels of intensity. It can thus be deduced that even basic emotions are still a

somewhat complex phenomenon and that their exact qualities and descriptions are rather elusive.

An "Adjective Clock" was devised for the purposes of classifying emotions by Hevner (1936). It locates emotions according to the sections of the Valence x Arousal Model [see Fig. 2], but has one important shortcoming in that it places all emotions on the edge of the diagram, and does not indicate their extremity *vs.* neutrality.

It is obvious that there are many different ways of categorising emotions, but none of these classifications mentioned are perfectly effective in providing a comprehensive framework for musical emotions to be classified (Scherer, 2004). In an attempt to provide a more useful method of classifying musical emotions, a diagram was devised that puts some emotions

experienced in music in a more useful perspective [Fig. 3]. It uses emotions from the Adjective Clock as well as other literature showing emotions on the Valence x Arousal plane.

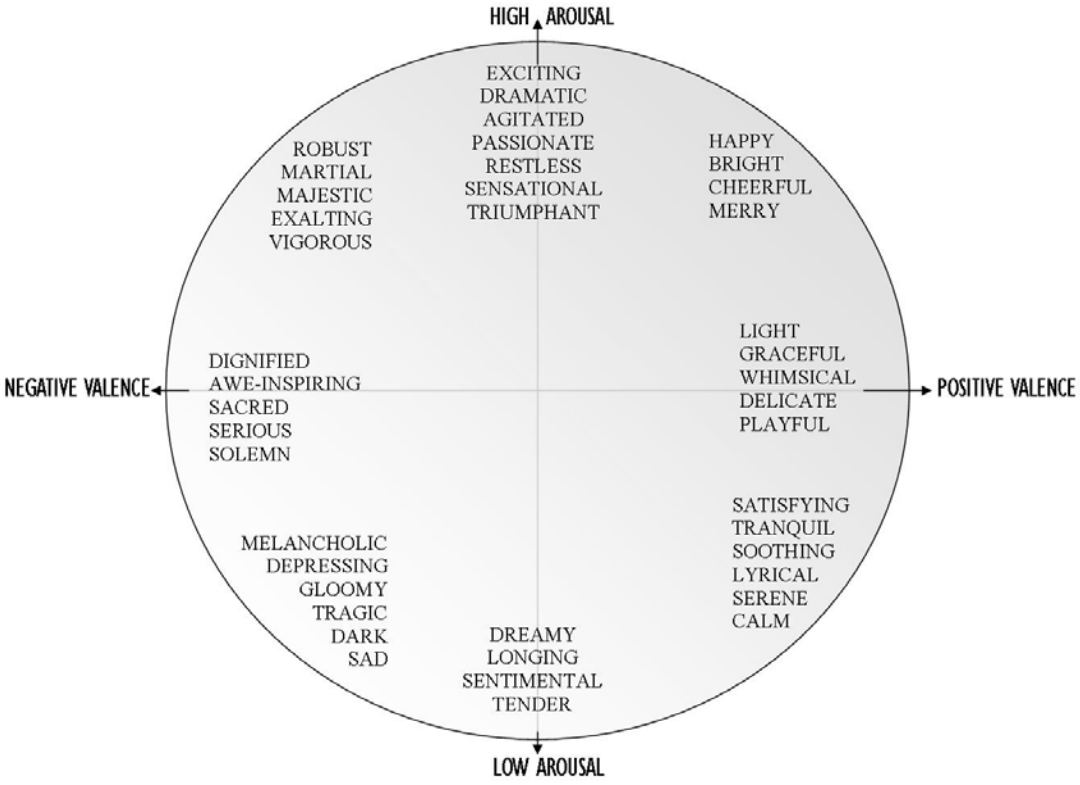


*Fig. 2. An adaptation of Hevner's Adjective Clock as published by Schubert (2010).*

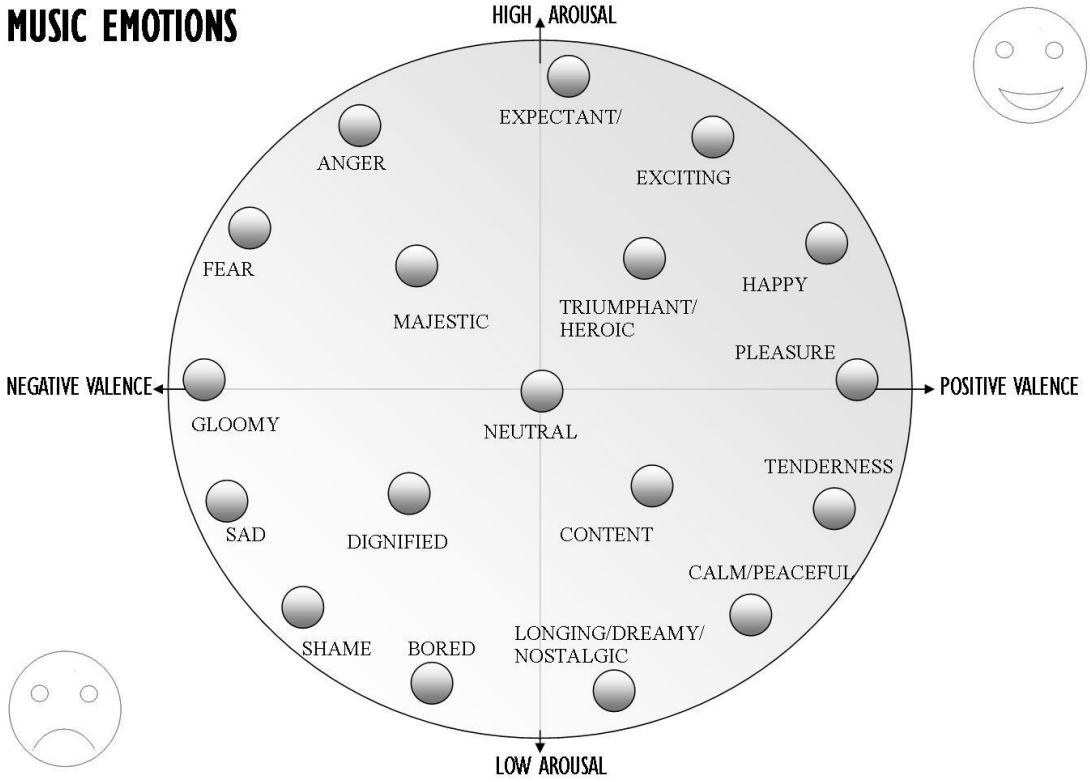


*Fig. 3. The Valence x Arousal Model adapted with some "musical emotions" for use in this dissertation.*

### *Absolutism vs. Referentialism*

While it was concluded that music expresses emotions, the question arises whether these expressions are contained *within* the music, or whether the emotions just emerge as a result of the music. These are two ontological standpoints called "absolutism" and "referentialism" (Meyer, 1956).

The absolutist standpoint considers music as an entity that refers only to its own structures, and is only there for the 'sake of music,' having no objective purpose of existence (Meyer, 1956; Vischer, 1987). The musical meaning "[…] lies exclusively within the context of the work itself, in the perception of the relationships set forth within the musical work of art […]" (Meyer, 1956:1) Because the expression is in a way inherent in the music, it would be assumed that the music can only have one meaning: the meaning intended by the composer (Gabrielsson, 2009). This was a popular concept among composers of twentieth century avant garde music (Bennett, 1942). Absolutists argue that in language, words always refer to a specific meaning – thus being referential – but music cannot point to something specific

outside of itself (Levetin 2006). According to the absolutist ontology, music can communicate aesthetic and intellectual concepts without using extra-musical signs (Meyer, 1956).

On the contrary, referentialists argue that musical meaning depends on the connection between a musical symbol and an object outside music. The music therefore refers, or points to, extra-musical objects or actions, like emotions, characters or events (Meyer, 1956; Gabrielsson, 2009). This viewpoint leaves more room for the notion that music is an art form open to interpretation (Bennett, 1942). Bennett further states that emotion is not inherent in the music itself, but that music rather *awakens* an emotional response in a listener. Levetin (2006) explains that emotion evoked through reference happens because music triggers the same type of emotional responses when, for instance, a person hears someone crying. Or, if the music moves slowly, it might mimic the typical actions of a sad human being for example, and this can be interpreted by the listener as a sad mood (Robinson, 2008), implying an appraisal of the character of the music (Moors & Kuppens, 2008).

The notion of absolutism *vs.* referentialism makes an important distinction between types of influence that music can have on the listener. For instance, when listening to Baroque music in the background from a contemporary perspective, it might create a mood, but not evoke a strong emotion, and so the music is viewed purely as 'music for the sake of music' (i.e. absolutism) for aesthetically pleasing reasons. But, when attentively listening to music from a dynamic scene in a film, the music may refer to different characters or events, thus being capable of creating sympathetic emotions in the listener (Gabrielsson, 2009).

Each of these standpoints have enough merit to claim its validity, making it possible that both are correct, and function under certain conditions (Hunter & Schellenberg, 2010). The distinction between the standpoints can be vague, and the listener's apprehension of the music may cross over between them during the course of the music (Gabrielsson, 2009), and so these standpoints can indeed co-exist (Meyer, 1956).

## *PERCEPTION VS. INDUCTION OF EMOTION*

In order to continue with the study of music and emotion it is crucial to understand the cognitive and psychological mechanisms involving the evocation of emotions in a listener through music (Juslin, 2009).

Music can represent emotions, which we understand, or *perceive* (Scherer & Zentner, 2008). Perception of emotion refers to a person identifying an emotion as expressed in people or musical artefacts through the gathering of sensory information (Livingstone & Thompson, 2006; Juslin & Västfjäll, 2008; Juslin & Sloboda, 2010). To the contrary however, we sometimes do *experience* the actual emotion represented by the music, which are *real* emotions. This is termed the *induction* of emotion (Brown, 2009; Juslin, 2009) and refers to the production of an emotion in a person (Juslin & Västfjäll, 2008; Juslin & Sloboda, 2010). It has a cause or trigger, and a reaction.

The ontological distinction between perception and induction of emotion through music is very important (Bennett, 1942; Meyer, 1956; Frances, 1988; Rosen, 2010) and even the ancient Greeks were aware of this (Juslin & Västfjäll, 2008). Francés (1988) explains this differentiation as follows:

> Evocation (induction), on the other hand, is always somewhat introspective. It appears to the subject as personal and contingent, not as a property of the musical structure but as an occurrence in the subject. It lacks the appearance of the objectivity that signification (perception) has […] (Francés, 1988:243).

## *PERCEPTION OF EMOTIONS IN MUSIC*

Perception of emotion is the most basic form of emotional intelligence, which, for example requires that we notice when another person is sad (Livingstone & Thompson, 2006). Emotions influence the voice tone and facial features of a person physiologically, thus allowing other people to judge the sentiment of that person. The ability to recognize emotion from a person's voice tone can explain some features responsible for certain structural features of music when explaining emotional expressiveness (Juslin & Lindström, 2010). Listeners depend largely on musical structures when decoding expressed emotions (Zacharopoulou & Kyriakidou, 2009). Most studies of music and emotion focus on perception of emotion (Juslin, 2009). If art is considered a medium of communication, then the

audience understands the message through perception, and they need to correctly perceive the message, or at least be able to provide some interpretation for the artwork to fulfil its purpose (Brown, 2009).

### *Accuracy of Perception*

Many authors agree that in a given group of listeners, the majority will be able to distinguish without much difficulty which emotion is being represented by music (Juslin & Lindström, 2010). This is supported by results from a number of quantitive tests (Schoen, 1927; Kivy, 1987; Gabrielsson & Lindström, 2001; Rosen, 2010; Konečni, 2010). Even individuals from different cultural and musical backgrounds could reliably distinguish expressed emotions in certain examples (Vieillard, 2008; Zacharopoulou & Kyriakidou, 2009; Hunter & Schellenberg, 2010). Despite this, some authors reason that this communication normally takes place within a certain cultural, social and historical context, and acknowledges even more successful emotional communication in these contexts (Kessler & Puhl, 2004; Vieillard *et al.*, 2008; Rosen, 2010). Kivy (1987) maintains that, within a very broad culture, there are established conventions, and so the subjective expression is as reliable as the convention itself. He mentions that describing musical expressions as purely subjective, is to deny the existence of a crucially obvious aspect of music.

The fundamental emotions that can be represented by music that almost all researches agree upon are *happy* and *sad* (e.g. Juslin & Laukka, 2003; Vickhoff & Malmgren, 2004; Vieillard, 2008; Hunter & Schellenberg, 2010). They are the most frequently reported emotions in arguments and experiments, with happiness being the most popular (Juslin & Västfjäll 2008; Hunter & Schellenberg, 2010). Sadness in music tends to evoke more complex, sometimes mixed, emotions (Hunter & Schellenberg, 2010). Other frequently reported emotions are love/tenderness, calmness, excitement, nostalgia, anger and threat (Juslin & Laukka, 2003; Juslin, 2009). However, while people could distinguish basic emotions, they could not always accurately discern between closely related affects (Francés, 1988).

*Semantics and Semiotics*

One explanation of the mechanisms responsible for the communication of emotion through music is through semantics (Fritz & Koelsch, 2008). This implies that musical structures can represent emotions, like a decodable language (Vickhoff & Malmgren, 2004), or associative meanings like pictures (Livingstone & Thompson, 2006). These associations are originated by social and cultural conventions, and even through evolution (Scherer & Zentner, 2001). The music may imitate the sound of objects, like bird sounds (Boere & Bottoni, 2008), imitate a conversational quality (Thompson & Coltheart, 2008), reflect the movement of a person experiencing a certain emotion, for instance, move in a slow, lethargic way as a sad person would (Robinson, 2008), activate a natural response, in the same way as when a sudden and loud sound gives rise to fright (Vuust & Frith, 2008) or use a stereotypical association, for example a wedding march (Fritz & Koelsch, 2008). Listeners often construct vivid mental 'stories' based on the music they hear (Gabrielsson, 2009).

In the Baroque era, many emotive qualities were attached to certain types of musical motives, for instance a chromatically descending bass line was indicative of grief (Kamien, 1976). The same is found in Arabian music or Hindustani *rāgas* (Meyer, 1956). These are associative signs within the music itself. More abstract concepts experienced by the inner person, which have no visual representations, may be communicated, such as struggles and victory, and human will and destiny (Bennett, 1942; Robinson, 2008), interactions between individuals, i.e. the dynamic nature of our emotional lives (Levetin, 2006). These may be extremely vivid experiences (Bharucha & Curtis, 2008).

However, some researchers to the contrary, believe that musical meaning is inherent, and does not need to be communicated through signs (Oelmann & Laeng, 2009). Signs are normally consciously perceived while the expression of emotion is more often sublime, even mysterious , Francés 1988). Listeners are normally not consciously trying to find signs in the music to which they are listening (Cohen, 2010). According to Gabrielsson (2009), listeners will more often correctly *perceive* intended emotion in the music, than identify representations of things made by the music.

Furthermore, the emotional experience as evoked by music is more abundant in different emotions than can be communicated through signs, therefore an explanation of musical emotions based on mechanisms of perception will not be able to encapsulate the richness of the emotional spectrum evoked through music, and can therefore not be accurate (Juslin & Västfjäll, 2008).

### *Speech Similarity*

If emotional reactions to music can be viewed within the broad context of communication (Trehub, 2008), it is not surprisingly then, that music and speech share certain characteristics (Thompson & Coltheart, 2008) since speech and emotion have a similarly strong relationship (Juslin & Lindström, 2010). The ability to recognize emotion from a person's voice tone can explain some features responsible for certain structural features of music when explaining emotional expressiveness (Juslin & Lindström, 2010). Musical structures imitate speech similar to voice inflections through contours of loudness and tone (Scherer & Zentner, 2001) that indicate question and statement (Pease, 2003 – dubbed antecedent and consequent) or imitate vowel-sound (Agostino *et al.*, 2008).

Even though emotional communication through semantic associations and speech-similarity seem like a very sound explanation for the communication of emotion through music, it seems that some authors regard this as a relatively insignificant contribution to the emotional experience. There are many structural features of music that are not linked to vocal emotive expression, and these are largely restricted to cultural contexts (Juslin & Lindström, 2010). Simpson *et al.* (2008) points out that the brain differentiates between speech and music at a very early stage, thus it would not perceive musical features in the same way as it does speech.

## *INDUCTION OF EMOTIONS IN MUSIC*

The mere *perception* of the intended emotional expression of a piece of music still does not explain why people can *experience* emotions because of music. Earlier, the concept of emotional induction was explained as the evoking of emotional responses in listeners, and some authors believe that music is very effective at achieving this (Brown, 2009; Rosen, 2010). In their strongest form, these responses may include bodily reactions such as chills or

tears, the notion of 'being moved,' feelings of awe, transcendence or longing (Brown, 2009). Empirical tests conducted by Vieillard *et al.* (2011) showed that musical excerpts of only 10 seconds in length were able to induce moderate intensities of emotion.

Where the accuracy of perception of intended emotion was rated as high by many researchers, the accuracy of induced emotion is normally less significant (Scherer & Zentner, 2008; Juslin, 2009). Personal and background differences can strongly influence how people experience induced emotion (Konečni, 2008). Within the framework of emotional induction, more factors come into play. Konečni (2008) proposes that emotions can be directly induced by the expressions in the music, but is more often induced through mediators such as contemplation, associations, evocation of memories or mental imagery, or appraisals. Scherer (2004) additionally proposes *empathy* as a mechanism of emotional induction. Brown (2009) suggests that most emotions are not the same emotions expressed in the music, but are resulting aesthetic emotions. The three main sources of emotional responses as a result of music, according to Thompson & Coltheart (2008) are "[…] psychophysical signal detection, expectancies, and emotional amplifiers" (Thompson & Coltheart, 2008:598).

However, Juslin & Västfjäll (2008) propose a comprehensive theory to explain emotional induction: they present six mechanisms, explained below, which relates to various levels of brain functionality that can all contribute to the induction of emotion through music. These mechanisms can work simultaneously, and they can account for the richness of emotions that can be experienced while listening to music. Their six mechanisms are:

a) Brainstem reflexes,
b) Evaluative conditioning,
c) Emotional contagion,
d) Visual imagery,
e) Episodic memory and
f) Musical expectation.

*Brainstem Reflexes*

This component has to do with the body's reaction to sound, as opposed to music. Music activates many parts of the brain, of which the brain stem is the most primitive part. The brainstem has the function of signalling potentially dangerous situations, and activates motor functions if needed. This mechanism can be responsible for heartbeat and breathing changes in the body (Juslin & Västfjäll, 2008). The brainstem classifies sounds as potentially dangerous when they are fast/sudden, loud, noisy or of very low or high frequency (Levetin, 2006; Boere & Bottoni, 2008). Musically this would extend to fast temporal patterns or dissonant sounds, and it can be deduced that rhythmic patterns and sudden dynamic changes would activate this mechanism.

Observing the above, it can be assumed that brainstem reflexes normally account for unpleasant reactions such as fear, but will also calm the body when exposed to relaxing music, or predictable patterns (Levetin, 2006). These reactions should be consistent irrespective of differences in personal or cultural backgrounds.

*Evaluative Conditioning*

When specific events that evoke certain emotions have repeatedly been associated with a piece of music, this emotion can be induced when the music is heard again. This mechanism is called 'evaluative conditioning' by Juslin & Västfjäll, and can operate even when the listener is not attentively listening. The same concept was mentioned by Scherer & Zentner (2001), but they termed it *associative coding.*

A limited number of studies on evaluative conditioning have been conducted because of its highly personal nature, different methods of learning by individuals, and for the reason that music is in this case only stimulating a conditioned emotion, instead of directly evoking the emotion. Studies have indicated that emotions can be evoked through evaluative conditioning upon hearing a single note. In addition to being a highly personal attribute, it also functions within cultural contexts, and is then often called "connotations" (Meyer, 1956). It was also used by composers such as Bach, Pachelbel and Buxtehude, who knew that their audiences had very precise associations with certain chorale melodies, and they

could, upon introduction of these melodies in their compositions, reliably evoke certain emotional connotations (Kivy, 1987).

In a film, for example, certain repeated events may be accompanied by a specific musical theme or *leitmotiv*. If this theme is used later during the film, viewers may have associated this theme with the specific type of event, and will thus expect the event to occur. The director may use this to advantage by either deliberately preparing the audience for the event to follow, or by creating an expectation followed by an alternative event, thus surprising the viewer (Cohen, 2010). Similarly, in the context of commercial film, viewers are conditioned to associate certain styles of music with certain genres or types of events (Bezdek & Gerrig, 2008).

### *Emotional Contagion*

> The action of the other triggers a spontaneous tendency to imitate, and this tendency makes us feel the emotion (Vickhoff & Malmgren, 2004:7).

When a person perceives a motion in another person, there is a tendency to mimic that movement. Similarly, one person laughing, yawning or crying may cause onlookers to do the same (Vickhoff & Malmgren, 2004). In a discussion on Aristotle's viewpoints on music, Grant & Palisca state that "music that imitates a certain passion arouses the same passion in the listener" (Grant & Palisca, 2001:6). In the same way, when a person *perceives* an emotion in music, they may start to *experience* that emotion while listening (Brown, 2009; Hunter & Schellenberg, 2010). This tendency is based is on the principle of empathy and is called *'emotional contagion.*' In connection to musical emotion, emotional contagion occurs when a person internally imitates the emotion represented by the music.

When music contains influxes similar to speech, this mechanism can be particularly effective. These influxes can refer to the nature of the composition, or to an expressive performance, where a musician can control his instrument to mimic vocal expressions of an emotion.

### *Visual Imagery*

A person can, when listening to music, stir up mental images, like that of a beautiful landscape for example. Much of these images can be related to movement, e.g. an ascending melody signifying something rising up in the air. Where language often lacks

descriptive words to describe the feelings brought about by music, visual images provide a helpful alternative for the listener wishing to be involved emotionally in the music. However, these images are not valuable to the researcher of music and emotion unless a psychologist can decipher these images according to understood emotional terms (Meyer, 1956).

This process can be controlled to a great extent by the listener, and has the ability to amplify the emotional expression of the music considerably. For instance, the interactions between the music and the images evoke emotions in the listener, and the listener's imagination may develop the image into something far removed from the original representation (Meyer, 1956). Repetition and predictability, along with slow tempi in music are regarded as effective elicitors of visual imagery (Juslin & Västfjäll, 2008).

### *Episodic Memory*

Levetin (2006) explains that every time a person hears a piece of music, the brain searches its memory module to find this pattern. But in the case of a new musical pattern, the brain will create some sort of association or memory link to this pattern. Any memory can be recalled if the correct stimulus is given, and music is a very effective stimulus for recalling memories. Thus, if a piece of music is heard at a certain stage in time, or a certain place a few times, memories related to this time or place might be called up when this music is heard at a later stage in the person's life. Because much exploration of oneself occurs during adolescence, music is particularly effective at recalling memories from when a person was between fifteen and twenty five years of age (Alcorta *et.al.*, 2008; Juslin & Västfjäll, 2008).

Juslin & Västfjäll (2008) are of the opinion that this is one of the most frequently activated mechanisms with regards to musical emotions. Even disciplined analytical listeners may find it hard not to be influenced by this mechanism (Meyer, 1956).

### *Musical Expectation*

Musical expectation is foundational to my research, as this is the only mechanism that can be properly controlled by the composer because it is intimately tied to the musical structures (Vuust & Frith, 2008; Krumhansl & Agres, 2008). It is related to the aspect of anticipation, and is regarded as highly important in the operation of musical emotions. Musical expectation is further described as the closest link between music theory and neural

theory (Levetin, 2006). A comprehensive and pioneering book on this subject was published in 1956 by Leonard B. Meyer. His general hypothesis states that: “Affect or emotion-felt (induced emotion) is aroused when an expectation – a tendency to respond – activated by the musical stimulus situation, is temporarily inhibited or permanently blocked (1956:31). A musical phrase may lead to either a predictable continuation, or may surprise the listener with an unexpected continuation. It ultimately implies that the emotional meaning of a musical work is dependent on the expectations created by the musical structures. Thus, by studying the musical score, an objective overview of the emotional meaning of a musical work may to some extent be obtained.

Musical expectation works in three stages:

a) Hypothetical meanings, which are the possible and probable continuations which are expected before it happens. The resolution may be delayed.
b) The Evident Outcome, being the actual outcome. This may be a resolution, a delayed resolution or a violation or surprise of expected resolution. This leads into the next stimulus that will create the next expectation.
c) Determinate meanings – the combination of expectations and resolutions thereof forming a certain context throughout the piece (Meyer, 1956:36, 37).

Meyer states that this mechanism is dependent on the learning and the familiarity of the listener with music of a certain style, thus the personal and cultural background of the listener will influence the effectiveness of this mechanism. As we listen longer to the piece of music, or get more exposure to that form, our ability to create expectations in that context increase. The brain forms neural networks that represent these structures, which becomes a person’s internal set of rules about the music, just as a person, even a child, can detect malformed sentences of the mother language (Levetin, 2006).

Music cannot create unexpected events as such; it needs to resolve in order to create meaningful aesthetic purpose. An expectation that is satisfied provokes positive feelings. Expectation that is denied/falsely met provokes negative feelings (Huron & Margulis, 2010). The mind will favour, or expect, the situation that has been observed to be the most consistent within the piece or style of music. Evoking of emotions (other than that of extreme stability and security) relies strongly on the controlled setting up and violation of

expectations. These violations can occur in any of the structural aspects of the music, but they should occur in order for the music to stay interesting (Meyer, 1956).

Neurologically, it is explained as follows: From before birth, certain musical structures form neural pathways, or *schemata*, in our brains. We rely on these schemata in order to understand and appreciate music (Levetin, 2006; Holochwost & Izard, 2008). Upon hearing a sound, the brain immediately separates aspects of the sound, such as timbre, loudness and spatial location for processing by different brain functions. After processing the sound, a higher level function predicts the continuation of the sound. After hearing the first notes of a piece of music, the brain establishes whether the specific piece has been heard before. It also immediately establishes features like the metre, tonality and style of the piece. The brain imposes a schema based on what has been heard before, and compares it to what is being heard (Levetin, 2006). It then makes certain predictions as to what will most likely follow musically. This prediction is based either on a memory of the particular piece, or a probable development in the context of the style of the music. As the music continues, the brain continuously checks the structural features of the music and updates the imposed schema. From this platform, the brain can make estimates as to where the music will lead, and so forms expectations (Vuust & Frith, 2008).

As expectations are set up and violated, the brain has to constantly recalculate the possible outcomes of what may occur next which keeps the listener interested (Krumhansl & Agres, 2008). This prediction is complemented by imagination, tension, reaction, and appraisal (Thompson & Coltheart, 2008). The variation between predictable and surprising material creates relaxation or tension. Tension in this sense is not routinely experienced negatively; rather, it is the manner in which resolution of the tension takes place that determines whether the tension is experienced positively or negatively (Krumhansl & Agres, 2008). The tension and resolution creates motion in the music. This in fact, is the source of the joy of the musical experience and can be figuratively related to the way that music represents human life, which breathes by a swelling and contracting, that speeds up and slows down (Levetin, 2006).

Expectation is regarded as an automatic reaction, often unconscious, which becomes conscious when the expectation is interrupted. Sometimes, we have a clear idea of what the

resolution of an expectation ought to be and at other times there are many possibilities. Whether we are convinced or uncertain about the expected outcome is less important as our expectation is focused on the fact there has to be a resolution. This is because expectation – not fulfilment of the expectation – is rewarded by the body with the hormone dopamine. This is the same hormone that makes us enjoy the *anticipation* of food about to be served, and the expectation of a dissonant passage being resolved (Huron & Margulis, 2010). Since musical expectation originates from syntactic musical information, it is not surprising that Thompson & Coltheart (2008) rhetorically present the question as to whether or not so much neurological activity can be triggered purely by the music itself. This abundance of neurological activity is what leads to the induction of strong emotions (Juslin, 2009).

Musical expectancy can thus be seen in the light of a cognitive process. As explained earlier, an emotional experience occurs as a result of a cognitive goal reached or blocked. The expected resolution of tension equals the goal, and the actual outcome the reaching or blocking of the goal (Meyer, 1956). Meyer continues to explain certain emotional phenomena related to musical expectation: Ambiguity arises when the probability of different outcomes are equal. A lack of clarity as to the intended direction of the passage in music gives rise to tension and uncertainty, as the listener is unsure of the probable outcome and the mind predicts a return to stability and clarity. This will be more so closer to the beginning of the piece when the listener has not yet firmly established the trend of the music. If the uncertainty prevails, it will inevitably result in a degree of disgust. During a delayed resolution, the listener expects a resolution that instead goes through another phase before ending in a resolution. The mind realises other possible continuations of the music, creating suspense in the listener as to what the actual outcome will be.

Suspense increases when the mind of the listener can momentarily not supply a possible continuation, and if this condition prevails, he will not feel in control, resulting in feelings of anxiety. The longer the resolution is postponed, the greater the reward after resolution finally occurs. Aesthetic suspense is worthless if the resolution does not occur.

Surprise results when something occurs that was not anticipated, for example, when the music was expected to continue in the prevailing style. When such a surprise occurs, the

mind instantly updates the context, finding reasons for its cause within the known stylistic framework. It will also use the syntactical information that follows to determine the cause and new direction. If no reason for the surprising material can be found, it may either be seen as humour or it may become an irritation.

If a lack of tension occurs, music can be labelled as uninteresting. This is typical of so-called "elevator music." Music can also contain too much tension, making the music unpleasant, for instance the bebop style of jazz music as presented to lay listeners. Levetin (2006) reckons that a composition is successful or not based on the balancing of these cues:

> Bringing all these factors together is the task of the composer. Most of us are very discriminating listeners, and when the composer gets the balance just slightly wrong, our expectations have been betrayed more than we can stand, and we switch radio stations, pull off the earphones, or just walk out of the room (Levetin, 2006:75).

## *OTHER THEORIES*

### *Cognitive Appraisal*

An alternative explanation for the ability of music to induce emotion is proposed by Konečni (2008; see also Moors & Kuppens, 2008; Thompson & Coltheart, 2008; Scherer & Zentner, 2008; Juslin & Västfjäll, 2008), dubbed *'cognitive appraisal.'* According to Konečni's theory, emotions are not induced by the music itself, however, the aesthetic evaluation of the music, the images, contemplations, memories and other associations which are called up in the mind of the listener are evaluated, or appraised, in a certain manner. The emotion is thus evoked by the appraisal of the non-musical object.

### *Action-Perception Theory*

Another concept called the "*Action-perception Theory"* by Vickhoff & Malmgren (2004) considers the listener's *perception* at the time of listening, his/her *implicit and explicit knowledge*, *sensorimotor schemata* and *imitation*.

a) *Perception* describes the listener's level of attention to the music, the listening environment, and the subjective way that he/she interprets the emotional content of the music at that time.

b) *Implicit knowledge* refers to all the associations the listener has made to music during his/her lifetime, which is strongly influenced by personal background. This can trigger mechanisms like those of evaluative conditioning, episodic memory and cognitive appraisal.

c) *Explicit knowledge* is knowledge that is not restricted to the person itself, but what the person knows is culturally and universally recognised.

d) *"Sensorimotor schemata"* is a collective term used by the authors that covers all neural mechanisms used to sense and act upon stimulus. The most important of these would be sensory perception (e.g. visual, aural and motor actions (tendency to respond, for instance to dance). Sensorimotor schemata are involved because of the relationship between music and motion.

e) *Imitation* refers to the mechanism of emotional contagion, or empathy. It occurs through the function of mirror neurons which normally come into play when one person automatically mimics the facial expression of another person, or when the passenger in a vehicle stomps at the floor when the traffic light suddenly turns red.

The Action-Perception theory is described as follows: a composer may perceive or experience an emotion, for example joy. He wants to communicate this emotion through a musical composition. His implicit and explicit knowledge relating to joy activates his sensorimotor schemata because his body knows how to detect and imitate nuances that indicate joy. The response of his sensorimotor schemata influences the manner in which he imagines the composition, and ultimately his use of musical structures to complete his composition. Thus, the experience of joy is embedded in the composition. As the listener attentively listens to this composition, his sensorimotor schemata recognise the patterns as joyful because of his implicit and explicit knowledge of joy. This automatically triggers imitation of the perceived emotion by the mirror neurons, leading him to experience joy. Perception is thus automated as a result of the implicit and explicit knowledge of the listener so that feelings generated by music are instantly evoked, and do not need to be mediated, as proposed by Konečni (2008). According to this theory, representations embedded in music are not viewed as signs, but rather as movements, relating to the notion of vitality affects (Stern, 1993).

*The Lens Model*

Lastly, the Lens Model was devised by Brunswik in 1956, (in Juslin & Lindstrom 2010), but developed and expanded by Juslin in 1995 and 2000 and termed the Extended Lens Model (ELM, Juslin & Lindström, 2010). This theory is unique in that it considers the musical features added by the performer of the music. The ELM is a graphical representation showing how composer and performer features work together to produce music, and how the listener in turn interprets all these features in order to understand the intended emotion. The ELM is related to the Action-Perception Theory in that it explains the emotional attributes of music as a number of factors combining and being embedded in the music.

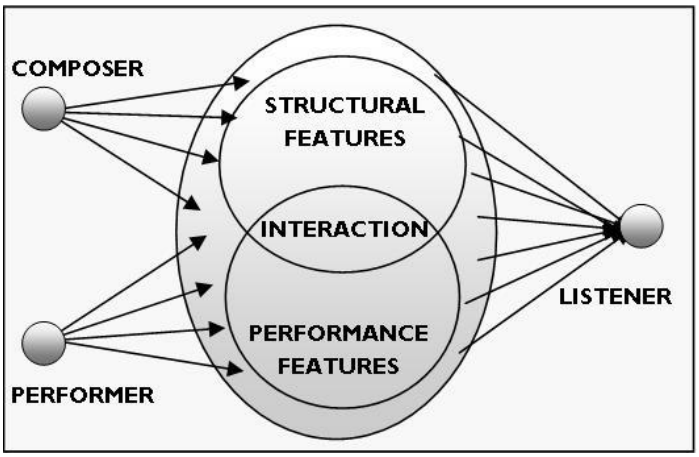


*Fig. 4. A simplified version of the Expanded Lens Model as presented by Juslin & Lindström (2010).*

According to this theory, the process of emotional communication through music involves the composer, the score containing the musical structures, the performer, the listening environment and the state of the listener – a complicated process (Baraldi *et.al.,* 2006). Some parts of this process may be omitted in some circumstances (Gabrielsson & Juslin, 1996). For example, during an improvised performance, the performer becomes the composer, and the musical structures exist only during the moment of performance. Or, in electronic music, the composer also performs the work by means of programming, and the composition is stored electronically. In this case the score merely exists as MIDI (Musical Instrument Digital Interface) information, or at least as a transcribable piece of music in audio format. Note that the musical structures are not exclusively contained in the score;

the performer also influences the musical structure when interpreting it by adding embellishment such as ornaments, vibrato and rubato (Juslin & Lindström, 2010).

### *Hypothesis: An Additive Theory*

The problem statement presented as the first sub-aim in the introduction to this dissertation; to provide a theory explaining the psychological, physiological and neurological mechanisms of emotional communication through music, is complicated by the many different approaches in existing literature which attempt to answer this question. I suggest an hypothesis employing an additive theory that encapsulates the core of the theories presented above.

My hypothesis states that music can represent emotions and that this is reliant on expressive cues embedded within the music (e.g. Meyer, 1956; Juslin & Lindström, 2010). The following observations are made:

a) All emotions can be located on the Valence x Arousal Model. Their locations are determined by their varying degrees of activity and pleasantness.
b) Music can express degrees of activity and pleasantness, and by presenting the correct amounts thereof it can imitate certain emotions.
c) Because *music* contains varying amounts of activity and pleasantness, the composer does not need to have an intention to write music representing a specific emotion for emotion to be expressed through the music.
d) Specific pieces of music should generally be able to evoke the same basic emotions among persons of different personal and cultural backgrounds because the experience of valence and arousal is not determined by personal or cultural background.
e) The placement of emotions on the Valence x Arousal Model is not exact, nor consistent according to existing literature. Therefore a degree of inaccuracy regarding the evocation of more complex emotions should be accounted for. In these cases the misrepresentation may only differ slightly, implying that the general emotional meaning will still be communicated.
f) Personal and cultural differences, which have an effect on some of the induction mechanisms discussed, will only create different nuances in the interpretation of the

emotional content of the music, but the basic emotional interpretation should be consistent.

According to Trehub, “presumably, composers and performers strive to influence the affective state of listeners – to move them or connect with them in one way or another” (2008:598). Trehub’s presumption should be challenged, because not all composers intend the communication of an emotion to be the goal of their compositions.

The model presented in Fig. 5 below, uses my hypothesis to explain the process by which emotion is embedded in the music regardless of the intent of the composer. Two hypothetical scenarios are sketched to explain the process. The scenarios consider different intentions of the composers, different types of extra-musical objects, the six mechanisms of emotional induction, and the theories around music and emotional communication presented by other authors.

The process of emotional communication through music starts with the composer and the intent of the composition. A composer may place different amounts of emphasis on the emotional intention of the music.

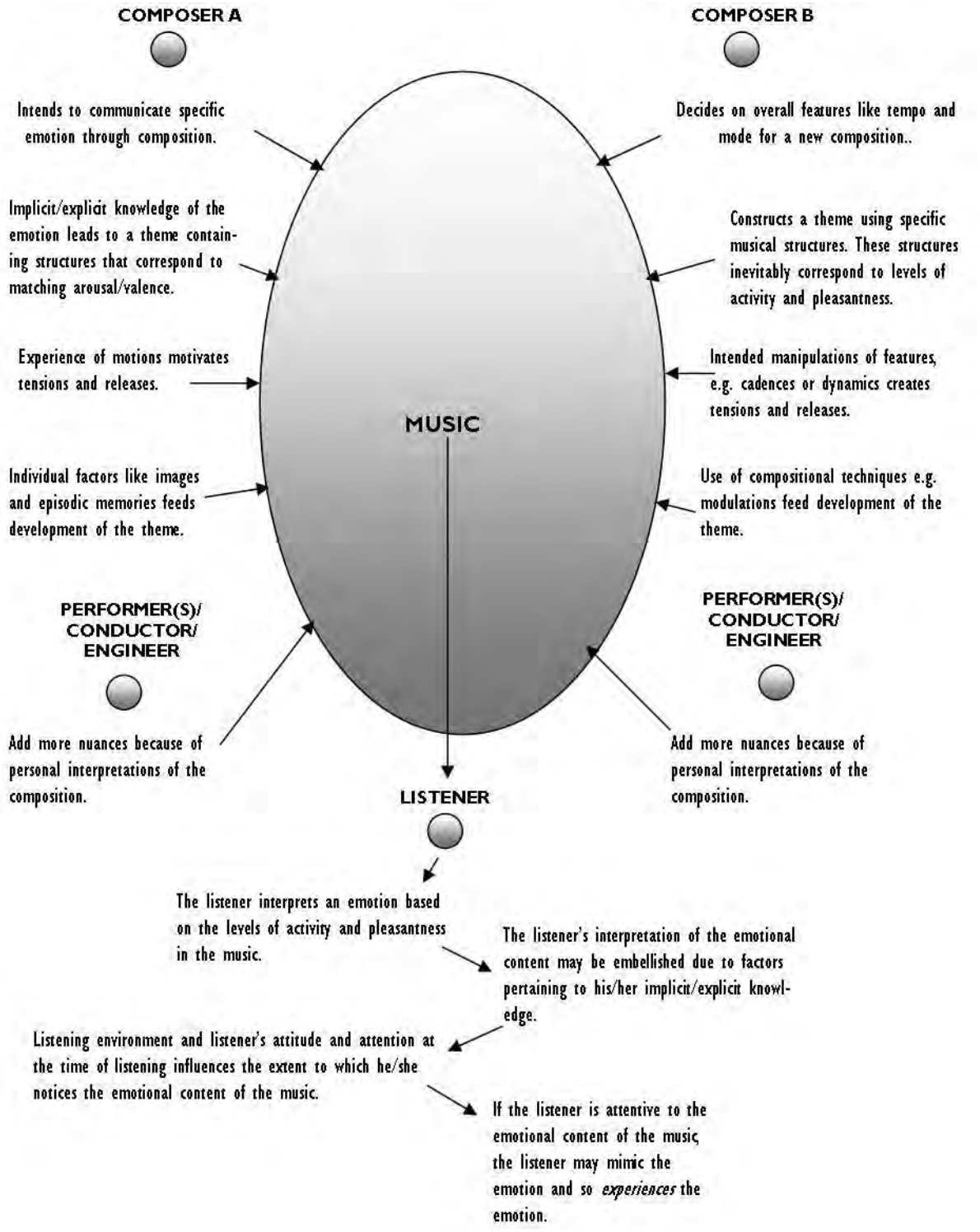


*Fig. 5. A schematic representation of the hypothesis presented.*

In *scenario 1,* the composer wants to convey a specific emotion and starts by imagining the experience of that emotion, for instance tenderness. Through his experience of tenderness during his lifetime (his implicit and explicit knowledge), this emotion calls up certain

attributes which will be related into musical structures. The level of arousal of the emotion is one attribute, and will determine the amount of activity in the music. In the case of tenderness, the level of arousal will be low. The appraisal of tenderness (valence), in this case, positive valence, will indicate the pleasantness or unpleasantness of the music. The structural attributes of the music chosen may also be connected to smooth bodily motions (e.g. caressing), speech patterns (e.g. slow, thoughtful phrases with little to moderate differences in intensity) or mental images (e.g. a flower garden). Since the latter examples are individual experiences, it may provide unique interpretations of this emotion in the composition. All of these experiences consciously or subliminally influence the development of the theme, the creating and resolving of tensions through the rhythmic, melodic and harmonic movement of the music. The composer carefully indicates expressive cues on the score. When the music is performed and recorded, the musicians and engineers closely adhere to the instructions on the score.

When someone listens to the music, the levels of activity and pleasantness of the music, together with the tensions and resolutions, indicate the attributes of tenderness. The listener recognises this emotion consciously or subliminally. As the music unfolds over time, his mind and body react to the small but regular tensions and resolutions. The intuition of his emotional intelligence causes him to mimic the emotion internally by becoming aware of his 'heart feelings.' He may also experience a tendency to assume a facial expression or bodily posture associated with this emotion. As the listener inhibits the tendency to physically react, the emotion grows in his mind, and eventually becomes consumed by it. It may call up images in his mind, or remind him in some way of an experience in his past. Even though he recognises and feels the basic emotion intended by the composer, his unique experience of the music creates a unique emotional experience, making the experience very colourful.

Conversely, in *scenario 2*, emotional communication may not be the motivation for the composition. The composer decides to write a piece with an *adagio* marking in a major key. His melodic theme employs appoggiaturas, suspensions and generally small melodic leaps with the periodic use of larger intervals. The rhythmic structures chosen are fairly simple and predictable, emphasising the appoggiaturas. Dynamic changes are not frequent, but employ

small changes over time. During the recording, the conductor and musicians assume that fairly large amounts of rubato will suit the piece.

When the listener hears this recording, he interprets the music as an expression of tenderness, because of the generally low level of activity and the pleasantness of the major key, as well as unique experiences through mediations like mental pictures of an idyllic flower garden and lover.

These two examples indicate that emotion may or may not be the goal of the music, but that the listener may experience a certain emotion regardless of the composer's intent. It substantiates the theory that music inherently contains emotional attributes, i.e. that music is, to a great extent, a semiotic communication process.

*CONCLUSION*

Hunter & Schellenberg (2010) indicated that listeners show an increase in appreciation for music if the expressed emotion is induced; i.e. the listener starts to experience the emotion that is embedded in the music. This leads towards the intended outcome of this research and necessitates the following question: **To what extent is the composer able to control the generation of emotion in the listener, and how may this be achieved most effectively?** Vieillard (2008) emphasizes that the link between perception and induction of emotion is constant, and is only a matter of degree. **Therefore, the composer wishing to communicate emotion through music should focus on effectively embedding the intended emotion in the music.** If the emotion is properly embedded within the music, it will be easy for the listener to perceive the emotion. The emotion can then be induced in the listener through the mechanisms discussed above. (Vickhoff & Malmgren, 2004; Juslin & Västfjäll, 2010).

# CHAPTER THREE

# THE ROLE OF MUSICAL STRUCTURES IN THE EXPRESSION AND EVOCATION OF EMOTIONS

## *MUSIC AND SYNTAX*

If the relationship between music and emotion is reliant on expressive cues embedded within the music itself (Juslin & Lindström, 2010), then it will be in essence possible to use the analysis of music to determine the emotional meaning of a specific piece of music.

Vischer (1987) draws all expressive qualities of music back to the physical nature of music which can be interpreted as arithmetic, proportions and ratios. Every mathematical aspect of musical sound is dependent on its position relative to the surrounding musical events: individual tones, harmonies and timbres are not pleasing or displeasing according to their musical attributes as such, but because of the inter-numerical relationships between the frequencies. These inter-numerical relationships give rise to the musical attributes, or structures, as we perceive them. Therefore, one definition of music is *organized sound* (Levetin, 2006).

The laws of audible frequencies can thus be likened to frequencies of light waves, where colours result because of frequency, or because of the combination of frequencies. This comparison between musical sound and light is in concordance with the views of some composers, such as Alexander Scriabin, Maurice Ravel, Stevie Wonder, Paul Simon and Lindsey Buckingham, who talked about their music as "sound paintings." It is therefore not uncommon to describe music in terms of "[…] colour …, brightness, location, texture, and shape […]" (Levetin, 2006:18). From daily life we know that two colours can complement or repel each other. In the same way, audible frequencies may complement each other through resonance, creating pleasing sounds.

When the ratios of different frequencies sounding together produce simple numbers, a harmonized, consonant sound will result. On the contrary, dissonant sounds may be recognized mathematically because of the complex ratios arising from the frequential relationships of tones sounding together (Vischer, 1987). These are normally unpleasing

sounds because the absence of resonance causes overlapping waveforms which creates an element of 'roughness' not only in the physical waveform, but also in the perception of the sound.

Even though dissonance is often pleasing when applied properly, there are neurological reactions to the presence of dissonance: Most natural sounds, like music and speech, are primarily consonant in nature, but an increase in dissonance is found in the waveforms of a distressed scream, and evolutionary theories suggest that dissonance is a universal identifier of threat. The brain differentiates between consonance and dissonance at a very primitive level of function (Levetin, 2006). Evidence is deduced from the fact that brainstem activity is triggered by the detection of dissonance. For this reason, a sudden dissonant passage in a piece of music may elicit a reflexive response (Peretz, 2008; Juslin & Västfjäll, 2008).

If music can be interpreted numerically, it would be possible to trace and document definite connections between specific musical structures and expressed emotions.

### *MUSICAL STRUCTURES: GENERAL*

The second sub-aim of this dissertation as proposed in the introductory chapter, is that the relationship between music and emotion should be considered from a musicological perspective. The focus is now shifted to the *musical* attributes, or structures that originated from the above mentioned numerical relationships. Fortunately, music theory provides us with the appropriate platform from which to analyse these relevant musical aspects (Krumhansl & Agres, 2008). It is indeed these structures which the listener uses to perceive the emotional expression of music (Gabrielsson, 2009).

> It was pitch [the triton] that had the medieval church in an uproar. [As well as polyphony in the Catholic church]. And it was timbre that got Dylan booed [playing the electric guitar at a folk festival]. It was the latent African rhythms in rock that frightened white suburban parents […] (Levetin, 2006:13-14.)

When examining the connections between specific musical structures and expressive representations, it should be considered that both the *overall* mood of the movement/piece/song – which would include aspects like tempo, mode and form – as well as the smaller structural segments – i.e. rhythmic structures, dynamics, modulations, etc. – should be taken into account (Meyer, 1956; Davis, 1983; Scherer & Zentner, 2001;

Krumhansl & Agres, 2008). This differentiation will be called the *global* and the *local* aspects of the music (Brown, 2009).

In some cases, as in that of tempo, a global perspective of certain musical structures need to be taken into account in order to best describe the general characteristics of the structure at hand (Scherer & Zentner, 2001). The average level/occurrence of these structural aspects, as well as the amount of their variability should be studied (Juslin & Timmers, 2010). Davis (1983), reiterates that the *development* of the piece plays an important role in revealing the intended 'message' of the composer. It is still important to isolate certain local moments in the music that have strong emotional nuances. This is however difficult because music moves and develops over time (Meyer, 1956).

*SPECIFIC MUSICAL STRUCTURES:*

*Tempo*

Tempo is regarded as one of the most important contributors to emotion in music (Juslin & Madison, 1999; Zacharopoulou & Kyriakidou, 2009; Gabrielsson & Lindström, 2010). Tempo has been demonstrated to influence mainly the arousal factor, and was shown to be reliable in the manipulation thereof (Husain *et al.*, 2002).

Fast tempo is generally associated with high arousal emotions, such as happiness or anger (Juslin & Madison, 1999; Vieillard *et al.*, 2008; Hunter & Schellenberg, 2010) while slow tempo is associated with low arousal emotions like melancholy/sadness (Juslin & Madison, 1999; Vickhoff & Malmgren, 2004; Vieillard *et al.* 2008; Hunter & Schellenberg, 2010). Intermediate tempo can indicate peacefulness (Vieillard *et al.* 2008). Gabrielsson & Lindström (2010) propose the idea of "subjective tempo" which refers to the perception of 'busyness' of music. It is influenced by metronome marking, sound event density, perceived metre/pulse (e.g. 2/2 or 4/4) and factors like harmonic and melodic rhythm. High note density adds to the perception of fast tempo (and *vice versa*), but low note density coupled with fast tempo (or *vice versa*) causes ambiguous responses. Interestingly, people tend to have a remarkable accurate memory for tempo, and can detect a 4% variation (Levetin, 2006).

*Rhythm*

After tempo, rhythm is the second most important factor contributing to emotion in music (Gabrielsson & Lindström, 2010). Rhythm and metre are the driving forces of music and are considered as such in almost all cultures. One piece of evidence supporting the importance of rhythm in triggering responses from people is that a drum solo is very often the most loudly applauded component of a jazz performance (Levetin, 2006).

The fundamental building block of rhythm is pulse, or beat. This is a regulated occurrence with all occurrences receiving equal importance (i.e. no accents) and duration. Metre occurs when an accent is consistently placed on predetermined beats. Rhythm is normally a more inconsistent occurrence happening in relation to the metre, and often occurs between beats on fractions of the beat (Meyer, 1956). A beat can be subdivided and accented in different ways, and in popular music this is referred to as the 'groove.' According to Levetin, the groove is the predominant differentiating factor in the classification of different genres of popular music. Even a constant-moving beat, or metre, can be changed slightly in parts of the music to emphasize nuances of the music in any style. He proposes that a predictable beat is essential in eliciting responses from listeners (2006). Agostino (2008) proposes that different rhythms in music have different emotional connotations, and in dance, the emotional meaning of a slow waltz differs substantially from that of a marching rhythm.

Time-keeping mechanisms are mostly controlled by the cerebellum and thus rhythmic and metrical functions are mostly perceived sub-consciously, and may influence other physiological time-keeping functions like heart rate and breathing (Levetin, 2006). Rhythmic events like syncopations and anticipations have shown to cause 'heart reactions' (Juslin, 2009). Irregular rhythms have been shown to indicate fear as an emotion in music (Vieillard *et al.,* 2008). A rhythmic break in the music gives a heightened sense of tension, because the consistent beat that presents the rhythmic focal points have disappeared for some time. As the beat returns and the soloist and rhythm section find each other again, a sense of relief is experienced in the mind of the listener (Meyer, 1956; Levetin, 2006).

*Timing Patterns*

Timing patterns is an umbrella term that refers to *local* time-related events in the music. These timing patterns are less crucial in the communication of emotion in music than tempo for instance, but are still capable and important in the relaying of emotion. Some of these are not necessarily tied to notated musical structures.

a) *Variations* in timing (rubato) are slight deviations from the score, or nuances, as introduced by a performer when interpreting a piece. Some notes receive more durational value than others as result of interpretation (Gabrielsson & Juslin, 1996). It adds to the expressive qualities of music (Vieillard *et al.,* 2011), helping to make music sound more animated (Juslin & Madison, 1999).

b) *Articulation* refers to the controlled attack of a note, the total duration, and the minute variations during the duration thereof (Scherer & Zentner, 2001). In an experiment, articulation was shown to be valuable in the expression of happiness and fear, where staccato was associated with high arousal emotions like anger, and legato with low arousal emotions like sadness (Juslin & Madison, 1999; Vickhoff & Malmgren, 2004).

c) *Vibrato* is a performance feature. It is a recurring and controlled deviation in pitch and/or intensity (volume). Its depth (amount of deviation) and rate (speed of recurring deviations) can be varied by the performer (Juslin & Madison, 1999).

d) *Timing* contrasts refer only to the difference in value between long and short notes. It is often judged according to the difference in percentage value between longer and shorter notes. For instance, in a passage containing dotted quarter note rhythms with eighth notes, the dotted note may receive more duration, appropriating duration from the following eighth note. This is indicated as a “sharp” contrast, and is useful to indicate high arousal emotions. The reverse would be called “dull” contrasts, and is often found in lower arousal emotions like sadness or peacefulness (Gabrielsson & Juslin, 1996).

While people have a strong memory for tempo, listeners seem to have less of an accuracy of perception as to timing nuances (Juslin & Madison, 1999).

Scherer & Zentner (2001) propose that the envelopes (i.e. the minute changes in quality) of energy, pitch and timbre of a note should also be taken into account when considering the emotional content of music. Envelope is concerned with the periods of attack, delay, sustain and release of a sound (Edstrom, 2006). It is most often considered in terms of amplitude (loudness/intensity), but is also appropriate when the timbre changes in time (Juslin & Timmers (2010). The composer will consider these qualities when deciding on instrumentation.

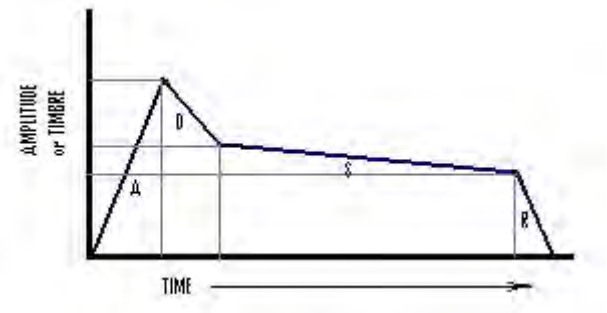


*Fig. 6. An example of an envelope pattern. Attack, Delay, Sustain and Release amounts are measured both in duration and amount.*

An example of these qualities referring to amplitude, is the different tones of a piano when compared to that of an organ, or a harpsichord. The harpsichord has a sharp attack and decay, as well as a short sustain and controlled decay (cut-off), while a piano would have all these attributes more moderately. The organ normally has an instant attack, no measure of decay, infinite sustain and instant decay. A trombone playing a note with a *sforzato-piano* marking would be a good example of change in dynamics *and* timbre; the sound will feature a hard attack with a slightly distorted loud tone, and a large decay settling into a low level of sustain with a smooth, soft timbre.

Lastly, rhythmic and timing patterns may be connected to *motion* perception (Juslin & Madison, 1999; Juslin & Västfjäll, 2008).

*Melody*

Melody is constructed from a series of pitches. A single pitch cannot have a functional meaning without a tonal context of a scale or harmonic structure; it needs to be surrounded by other pitches in order to establish a context and be able to carry musical meaning. Therefore a single pitch, or frequency, can have different meanings depending on its context. The perception of pitch is therefore a psychological construct, because we 'determine' its value of tension and meaning after considering its context in the scale or harmony of the moment (Lerdahl, 1996; Levetin, 2006; Lerdahl & Krumhansl, 2007).

Some studies have attempted to explain the meaning of pitch and/or melodic patterns. Examples are Lerdahl's (1996) tonal pitch-space model, which provides an account of the tension created by every scale degree, and Narmour's *implication-realization mode*l (Krumhansl & Agres, 2008). These studies point out that a hierarchy exists among the notes of the scale. All scale tones point towards the tonic, but with different amounts of attraction, thus causing some tones to be more stable than others. The 7$^{th}$ pulls the strongest, while the 5$^{th}$ pulls the least strong to the tonic. The same applies to chords, which have different levels of stability (Lerdahl, 1996; Levetin, 2006; Lerdahl & Krumhansl, 2007).

In an experiment by Juslin (1997a), performers were instructed to convey different emotions using the same melody. In order to accomplish this, it was found that they emphasised different notes in the melody to create the different renditions of the melody (Juslin & Timmers, 2010). This suggests that certain notes of the melody or scale may be valuable to the communication of specific emotions. The finding implies that the composer can place emphasis on different notes when composing a melody in order to communicate different emotions. Unfortunately, the study did not reveal enough information as to *which* notes were important to the communication of specific emotions. It may be hypothesised that the major 3$^{rd}$ will be emphasised in a content/happy rendition of a piece, while the tonic and perfect 5$^{th}$ will receive more emphasis during a triumphant rendition.

Juslin (2009) noted that melodic appoggiatura's and sequences can evoke strong emotions in a listener. Vickhoff & Malmgren (2004) suggest that small melodic leaps, as well as chromaticism, may indicate melancholy. Deliberate repetition of wrong-sounding notes in a composition or improvisation may result in quirky, or odd sounding melodies (Huron &

Margulis, 2010) Intonation is deviation of pitch, and is a performance feature. Slight variations of intonation can contribute to emotional expression. For example, sad melodies were found to be played slightly flat. Bending of notes was used in both tender and angry examples (Gabrielsson & Juslin, 1996). Ornamentation is both a performance and a score-based feature. It is successfully used in emotional communication of music. Ornaments include trills, appoggiaturas, tremolo and vibrato (Meyer, 1956; Juslin & Timmers, 2010). Ornamentations temporarily obscure the melody, creating an amount of doubt in the listener as to what the music should actually be (Meyer, 1956).

Melodic rhythm, melodic range and melodic contour and direction have received little attention. The only finding made was that ascending melodic patterns were regarded as "outgoing" (Gabrielsson & Lindström, 2010).

*Intervals*

The 12 tones of the octave within a tonal context have a hierarchy of stability. According to Bharucha (1984), a dissonant note is normally resolved to a stable note *of close proximity*. This explains the leading tone effect, or the fourth resolving down to the third which is in close proximity. He stresses that the resolving note *following* the dissonant note bears far more importance to the composition than the note preceding the dissonant note.

Oelmann & Laeng (2009) conducted empirical tests to determine the meanings of different intervals which they deem to be inherent within a cultural context. Their study concludes that intervallic structures do contribute significantly to the emotional meaning of a tune. The results from their tests do indicate this with fair reliability, but the evidence is not strong enough to generalise their findings. A summary of their findings is absorbed with other findings in Annexure 5. When considering intervals, a distinction is made between harmonic (simultaneous) and melodic (consecutive) intervals (Gabrielsson & Lindström, 2010). Gabrielsson & Lindström (2010) are of the opinion that melodic intervals are under-investigated. They also believe that melodic intervals may be very dependent on the influence of other factors, and that interval distribution has a very important role in the communication of emotion through music.

### *Register*

Register can also be a strong indicator of emotion in music (Brown, 2009; Gabrielsson & Lindström, 2010). Low register can indicate melancholy (Vickhoff & Malmgren, 2004). High register could be associated with higher emotional activity, and low register with lower activity (Gabrielsson & Lindström, 2010), but there is no strong evidence in support of this.

### *Mode*

The most common modes are major and minor, but prior to these, the church modes provided the basis of tonality in music. The Greek philosophers, like Socrates for example, were well aware of the difference in sound and influence of the modes on the morality of mankind (Wigram *et al.,* 2002). These modes were revived in jazz music in the previous century and are used as compositional techniques in some kinds of music (Pease, 2003).

Mode is a reliable indicator of the mood of a piece of music, and strongly influences the *valence* of the expressed emotion (Hussein *et al.,* 2002; Brown, 2009). Major is generally seen as happy, and minor generally as sad (Vickhoff & Malmgren 2004; Vieillard *et al.* 2008). This makes sense when compared to prompts made during aural training for music students, where major is explained to have a 'happy' sound, and minor a 'sad' sound (Cloete, 2008). Minor can also indicate other negative valence emotions like fear, while major can indicate other positive emotions like peace (Vieillard *et al.* 2008).

If mode influences valence and tempo influences arousal effectively, then it can be assumed that different combinations of tempo and mode can strongly influence the overall mood of a piece of music. Hussein *et al.* (2002) made some observations during tests on tempo and mode manipulations. One observation states that tempo manipulation had a bigger impact in pieces played in major mode. Another observation states that the mood of listeners improved when exposed to the piece in major mode, but was either unaffected or declined when exposed to the piece in minor mode. They also noted that listeners preferred a major piece to be played fast (which enjoyed the highest preference rating) and a minor piece to be played slowly (second highest enjoyment rating). The listeners least enjoyed a piece in major mode with slow tempo, or a minor piece with fast tempo. This may have to do with this setup evoking mixed emotions (Hunter & Schellenberg, 2010). In general, music in minor

mode tends to evoke more complex emotions than music in major mode (Hunter & Schellenberg, 2010).

Music in major mode, which has a positive valence, will result in positive, active emotions like 'happy' or 'heroic' when combined with high arousal factors (fast tempo). When the positive valence is combined with low arousal factors (slow tempo), it should result in emotions like 'tranquil' or 'sweet.' When music in minor mode, which has a negative valence, is combined with low arousal (slow tempo), it will evoke feelings like 'sad' or 'sinister,' but when combined with high arousal (fast tempo), will result in feelings like 'fearful' (Brown, 2009).

The minor mode is found to be rather intriguing. It is only applicable in Western music since the Renaissance. The "normal" affective state of the human mind is one of calm contentment and gentle joy. This corresponds with the emotions associated with diatonic music in major mode that has moderate tempi and dynamics. The 'anguish' associated with minor and chromatic passages are, like the musical equivalent, departures from the 'normal state of being' (Meyer, 1956).

> The theoretical and psychological basis for the affective power of the minor mode in Western music has puzzled and perplexed so many excellent musicologists and psychologists that it may seem rash to propose another answer here (Meyer, 1956:222).

Firstly, the minor triad is more dissonant than the major. The intervals of a major chord are more in line with the first natural harmonics, thus creating a more pleasing, 'happy' effect. In the minor, the third does not appear early in the overtone series as presented by Pythagoras, giving rise to more complex frequency interactions which in turn tend to evoke more complex emotional meanings, like sadness. Since the minor third is lower than the major it may evoke feelings of anxiety, being dropped, not strong enough (Meyer, 1956).

It is mistaken to only discuss the minor third as found in the minor triad, since the mode encapsulates more notes and more context than the mere triad. The options presented by the minor scale allow many more note options – 9 of the 12 available tones in the chromatic scale can be used, compared to the 7 tones of the major mode. Meyer suggests the inclusion of the flat 2 scale degree, derived from the Phrygian mode, giving us 10 out of 12 possible tones. Thus, the stronger affective quality of the minor mode can be because of its relationship to the chromatic scale. Both minor mode and chromaticism (because of its

similarities) bring about intense affects, like sadness, suffering, anguish (Meyer, 1956).He further proposes that the attractive tendencies of non-chord notes are generally stronger in minor than in major. The natural minor has no leading tone, making it quite unstable, because the absence of leading tone does not pull towards the stability of the tonic. For this reason notes borrowed from the major, creating the harmonic and melodic minors, became the norm.

Harmonically, the minor mode is more ambiguous and unstable than the major, largely because of the extent of harmonic opportunities made available by the many note possibilities. Because chromatic alterations are more characteristic in minor than in major (e.g. the Phrygian 2$^{nd}$), even more possibilities are available. The qualities of chords are more variable, with more diminished, and one augmented triad being available. The diminished 7$^{th}$ and augmented triads are uniform in construction, literally causing them to be without root, and thus no focal point or tendency. They can enable the music to develop into complete new directions harmonically. The minor mode is therefore effective for bridge passages, or introductions, because its relative instability tends to drive the music forward (Meyer, 1956). The instability of the minor mode seems to be emphasised by the strong effect of finality brought about by the *Tierce di Picardi*.

### *Harmony*

Harmony is seemingly an important factor in establishing the familiarity with, and expectations within, a piece or style of music. By age five, most children can recognize typical chord progressions of the music of their culture. Most people can immediately recognise a familiar chord progression, irrespective of the timbre used (Levetin, 2006).

Like notes of the scale, chords also fall into a hierarchy of importance, or of tension (Levetin, 2006), and can only operate within the basis of an established tonality (Meyer, 1956). Modulations are also creators of tension, and release is found upon return of the tonic (Robinson, 2008). Similarly, harmonic expectations, or false outcomes of these expectations, create tension, for example harmonic sequences, unprepared harmonies, or delayed resolutions (Vickhoff & Malmgren, 2004; Juslin, 2009).

The consonant notes in a tonal structure form focal points which orientate the listener. These notes cluster together to construct a chord which forms the focal point of that moment. Popular music follows this system very rigorously, since musical styles that do not rely on this system (e.g. 12-tone serialism and even many jazz compositions) require far more musical intellectual activity to be understood (Bharucha, 1984).

Theoretically, much is assumed about the effect of harmonic progressions. The plagal cadence is often nicknamed the "Amen"-cadence (Cloete, 1986), and hence we can imagine that this would have a peaceful/content expression. As Meyer points out, a deceptive cadence might be surprising, and the effective composer will use this to good effect. Similarly, chromaticism may be either seen as a type of ornamentation or as a deviation from the normal. It often speaks of something unusual (1956). In a study that investigated the effect of harmonic expectation and violation (Steinbeis *et al.*, 2006), a V – I chord progression resembled a stable harmonic progression, while a Neapolitan sixth was used as a highly unexpected progression. The study confirms that harmonic resolution can elicit physiological reactions in listeners, and it can be assumed that emotional reactions would also be elicited as result of physiological reactions.

Apart from the above-mentioned study, no other investigations on the effect of harmony on emotional reaction have yet been conducted except in terms of consonance/dissonance. A need exists to study the effects of harmonic progressions, chord qualities and harmonic rhythm (Gabrielsson & Lindström, 2010).

### *Consonance and Dissonance*

As with harmony and melody, consonance and dissonance can only function within the framework of an established tonality. The varying degrees of tension of specific notes in the scale, or chords in the key, can be related to their levels of consonance and dissonance. As has been noted above, the consonant notes in a tonal structure form focal points which orientate the listener (Bharucha, 1984). This implies that consonance/dissonance functions *within* the structures of harmony and melody, and it is not a structure as such. In tonal music, this interplay between levels of consonance and dissonance gives rise to affective meaning (Rosen, 2010) by providing an important basis for musical expectation (Alcorta *et al.*, 2008).

Consonance is viewed as stable, and dissonance unstable. When dissonance is unresolved it sounds unpleasant, but when it is resolved it is especially pleasing. Anger and irritation can be brought about by music containing a series of sharp, unresolved dissonances (Zentner & Eerola, 2010). Dissonance is more active and more negative than consonance (Gabrielsson & Lindström, 2010). Consonance seems to be favoured over dissonance, but dissonance is "woven" with consonance into the tonality and has a purpose in creating tension and unfamiliar elements that are essential in giving music deeper appeal, and prevents it from becoming boring (Levetin, 2006; Hunter & Schellenberg, 2010).

When the tonality is changed, the listener has to reorientate himself (Bharucha, 1984). A modulation to the dominant creates more tension than a modulation to the subdominant, because it is perceived as more dissonant (Rosen, 2010). The tension caused by dissonance can indicate emotions such as fear (Peretz, 2008; Vieillard *et al.* 2008).

### *Timbre*

Timbre is often likened to visual images, or other media of expression. Timbre can offer the same quality of contribution to music as colour provides to a painting (Vischer, 1987; Levetin, 2006), hence the paraphrase 'tone colour.'

The overall timbre of a piece of music is determined largely by the instrumentation and therefore also the style of music used, for example a solo violin *vs.* a full symphony orchestra, or the orchestra *vs.* a rock band. Locally, it refers also to the fine nuances of an instrument or voice, determined by the acoustic characteristics and materials of the sound source; for instance the sound of a tin alloy flute mouthpiece compared to a gold-plated one. These local aspects of timbre also play a role in human evolutionary functionality (Boere & Bottoni, 2008). As mentioned previously, a distressed scream contains irregular overtones, causing a certain dissonant timbre, which the brain interprets as a sign of fear or danger (Peretz, 2008). Other timbres, like the sound of a wolf's howl, can be associated with fear, or solemnity, for example (Boere & Bottoni, 2008). Musical instruments and voices can convey emotions in the same way, for instance the sensuality quality of a saxophone sound, the comicality of a bassoon in a staccato passage, or the soothing or distressed sound of a human voice in song (Levetin, 2006; Bharucha & Curtis, 2008).

Little research has been conducted on the expressive qualities of different instruments. Behrens and Green (1993, cited in Gabrielsson & Lindström, 2010) conducted tests where three emotions were expressed in improvised performances on violin, trumpet, voice and timpani. The violin could portray 'sad' and 'scared' well, while the timpani could express 'anger' very well. It could be argued that anger would naturally be better portrayed on a loud, deep-sounding percussion instrument like the timpani, and that more delicate emotions could be expressed effectively on a violin, which inherently possesses the ability to add a large variety of nuances to its sound. 'Soft' timbres, with less overtone content, is said to be associated with tenderness, or sadness, which are low arousal emotions. Contrarily, sharp timbres, with rich harmonic content, can be interpreted as anger which is a high arousal emotion (Hunter & Schellenberg, 2010).

### *Dynamics*

Loudness in music plays an important role in determining the arousal factor of the experienced emotion (Boere & Bottoni, 2008). It is often referred to as "intensity," which implies the amount of energy released, measured in decibels (Juslin & Timmers, 2010). Dynamic changes in the music evoke emotions, even if it is only tiny changes (Levetin, 2006). A lack of dynamics and general low volume in music may indicate sadness (Juslin & Madison, 1999; Vickhoff & Malmgren, 2004). High volumes of sound can indicate emotions like anger (Juslin & Madison, 1999).

## *META-STRUCTURAL FACTORS*

### *Musical Expectation*

> The formalist music-appreciator listening to Beethoven focuses on musical syntax – melodic, harmonic, and rhythmic – and the emotions aroused by "musical expectancies" may well be a mode of *understanding* the piece itself (Robinson 2008:593).

The topic of musical expectation has been discussed as a psychological mechanism involved in evoking emotions in a listener, but in this context it is seen from a musicological perspective, focusing on the syntactic structure. It can be deduced that the psychological mechanism of musical expectation is firstly caused by the musicological expectation, and is

then translated as a psychological expectation (Juslin & Västfjäll, 2008; Krumhansl & Agres, 2008).

A typical melody from the late baroque or early classical period would outline the tonic triad (Rosen, 2010), supplying the listener with the first important data upon which to base musical predictions; namely a tonality, as well as a rhythmic base (time signature). The listener makes predictions based on the specific piece of music being listened to (called *intra-opus knowledge* by Meyer, 1956). The listener knows that a melodic theme is likely to recur later in the piece (Krumhansl & Agres, 2008). In the case of popular music, the listener expects a chorus to return at various points in the song (Levetin, 2006). Whatever time period or style of music preferred, the underlying structures of the music would be learned and certain expectations of the music created (Meyer, 1956; Krumhansl & Agres, 2008). Different patterns recognisable in the relevant style are called "sound terms" (Meyer, 1956). These sound terms function on different architectonic levels, i.e. that a cadence for example has some meaning in its own occurrence, but within the context of the larger section becomes part of a greater meaning. The whole piece is also much more than merely the sum of the individual parts or sections, the collective occurrence of all the sections give rise to the meaning of the whole piece of music.

Metre is probably the most obvious of all sound terms functioning both locally and establishing its meaning in the global duration of the music. The cerebellum takes delight in establishing the metre of the music, and correctly predicting each new beat that falls. A continuing metre, or beat of a song, has a reassuring effect on the listener, knowing that while expectations are met, all is safe and secure. The brain does the same with the tonal base of song, finding security in the recurring tonic, almost like having a 'home base' to return to regularly (Levetin, 2006).

Some more principles presented by Meyer include the law of good continuation, stating that "A shape or pattern will, other things being equal, tend to be continued in its initial mode of operation" (1956:92). This implies that not only does the listener accept that a musical fragment will keep going in a certain fashion, but also that the entire piece of music would continue along a fixed path unless it is interrupted by a specific intention of the composer. Meyer (1956) also proposes a principle stating that a gap in a structural feature tends to be

filled. For instance, when an ascending melodic line skips certain scale tones, these tones may feature when the melody descends. Similarly, a melodic leap in one direction will expect the next note in the opposite direction. The direction in which a tone moves also influences our feeling of completion. A melody that descends toward the end is perceived as completed.

Saturation implies that when a certain fragment is repeated continuously, it builds up an expectation to change, develop or conclude. “A stimulus series which develops no process, awakens no tendencies, will, if it becomes the focus of attention, always appear to be incomplete” (Meyer, 1956:138-139). The same applies to a repeated pulse, with no difference in accentuation, and to a sustained tone that has no other apparent function. According to Meyer, if a passage continues at a certain intensity without contrasting points of activity and rest, it may instil a feeling of uncertainty in the listener, as the music keeps going like a car without brakes (1956). The principle of return states that: “[…] other things being equal, it is better to return to any starting point whatsoever than not to return” (1956:151).

There is a good example in the example of the jazz trumpeter, Miles Davis, who believed that the silence in between notes is just as important, if not more important than the actual notes. By creating space between notes, the listener is allowed time to anticipate the next note, and to wonder how the melody would develop until the next note hits (Levetin, 2006). Juslin (2009) mentions how violation of timing factors – syncopations and anticipations – has the ability to instil emotions.

Levetin (2006) provides a few examples of permissible ways to either set up, meet or violate expectations:

a) A deceptive cadence violates the expectation of resolution to the tonic.
b) An imperfect cadence creates the expectation of continuation.
c) The familiar blues chord progression can be reharmonised to provide violation of the expected progression.
d) The use of uneven phrases, like seven-bar phrases, violates the expected 8-bar phrase.
e) A repetitive ending creates the expectation that it will fade out, but it can violate the expectation by ending abruptly in the middle of a note.

f) Using of timbre/instrumentation that is unusual for a particular style.

g) A familiar song from one stylistic context is used within another stylistic context.

h) Suspension of the pulse can be unexpected, for example a rhythm section break in a rock song.

i) The use of a ritardando ending (or not) when characteristic (or not) to a style.

j) Atonal compositions containing no "home ground" or key can be used to convey feelings of weightlessness in dreams, resembling locations underwater or in space.

k) Melodic resolution to the lower tonic meets expectation. (The higher tonic in his reasoning is not the "home" note.)

l) Build-up of music using increasingly larger instrumentation.

m) Setup of the metre, but changing it soon afterwards.

n) Maintaining a rhythmical element, but altering it slightly in every repetition.

When expectations are violated beyond normal musical conventions, it often leads to surprise. As an example, Levetin (2006) describes Haydn's *Surprise Symphony* that builds a predictable pattern, and then interrupts itself with loud brass and percussion stabs that surprises the listener. Rosen (2010) uses Mozart's *A Musical Joke* as an example of how a musical expectation is set up, and then deliberately not met. The audiences used to that style of music would find this humorous. Music should reward the breaking of expectations by resolving back to the expected, still giving the listener a feeling of stability (Rosen 2010).

It is obvious that the meaning of a given set of syntactical information will be determined by its context. This opposes the idea that certain musical structures presented separately, like a set of intervals, or a certain chord quality, will reliably evoke certain emotions (Meyer, 1956).

### *Tension and Release*

Musical expectation can be seen as a form of tension and release. As expectations are created and violated, a state of tension is created in the listener which is released upon resolution of the violated expectation (Meyer, 1956; Krumhansl & Agres, 2008). These are not particularly positive or negative emotions that are created, but rather the content of the

artefact, which colours and shapes it the way the composer intends (Krumhansl & Agres, 2008), creating a pleasant, aesthetic emotion in the listener (Brown, 2009).

*Motion*

Motion and music are closely linked (Gabrielsson, 2009) in almost every culture globally (Levetin, 2006). Motion plays such an important role in music that it was proposed as an additional mechanism of the induction of emotion through music by Bharucha & Curtis (2008). In actual fact, they view the musical experience as consisting of affect, structure and motion.

Motion in music can carry some different meanings. Firstly, it connects to physical movement, which is typically dance.

a) Music eliciting physical movement

Neurologically, there are connections between brain regions responsible for movement and those responsible for emotion (Levetin, 2006). So, music connects to our emotions, and in turn our emotions want to express themselves through motion. Juslin & Västfjäll (2008) conversely argue that music stimulates movement through rhythmic entrainment, and this physiological arousal in turn evokes emotions. When people dance together, a function of mirror neurons come into play (Vickhoff & Malmgren, 2004; Juslin & Västfjäll, 2008). Bodily gestures are thus intimately tied to music-related emotions. In musical performance, bodily movement, musical gestures and communication of emotion are interrelated (Vieillard *et al.*, 2008). Fine nuances, like variation in timing patterns by the performer, can elicit motion responses in the listeners, which is relayed to emotional responses (Juslin & Madison, 1999).

Levetin (2006) believes that music should lead to a natural response in movement. Bharucha & Curtis (2008) are of the opinion that when this natural tendency to move to music is inhibited, this inhibition can elicit emotional responses as well. This may explain why classical music is typically enjoyed without physical movement, in which case the music is intended to stir inner responses. Music can thus be perceived to be representative of movements, which is the second meaning of motion in music.

b) Perceived motion in music

Movement in music is any many cases perceived as such because of the tensions and releases that are pulling to and fro (Bennett, 1942), like the waves of the ocean. We thus perceive motion in music, and we find it quite natural to describe music using kinetic terms (Gabrielsson, 2009) as emotion is essentially movement (Bennett, 1942) and both the music and the emotions it represents are dynamic (Vickhoff & Malmgren, 2004). Emotion and movement are the essences of life (Vischer, 1987). Just as life is a series of movements – growth and decay, speeding up or slowing down, turbulent or smooth, pausing and reflecting – so too does music reflect these aspects of life (Meyer, 1956; Levetin, 2006).

Lastly, music itself contains an impression of kinetic energy as it moves in certain directions. The melody moves up and down along a contour, harmony progresses at certain rates and in sequences away from and back to the tonic, and rhythm speeds up and slows down (Gabrielsson, 2009). Very often, the descriptive terms on a score contain reference to movements: e.g. *ligiero, andante* or *vivace* (Juslin & Lindström, 2010).

## *Expression in Performance and Production*

Performers strive to influence their audiences emotionally through their interpretations of the music (Trehub, 2008). Thus, an expressive performance amplifies the emotional content of the score in the same amount as the score itself (Scherer & Zentner, 2001; Gabrielsson, 2009; Juslin & Lindström, 2010; Vieillard *et al.* 2011) through interpretations and variations in tempo, timing patterns and contrasts, dynamics, articulations, accentuation, emphasis of certain melodic or harmonic segments and variations in attack and vibrato of individual notes (Bennett, 1942; Gabrielsson & Juslin, 1996; Juslin & Madison, 1999; Juslin & Timmers, 2010; Vieillard *et al.,* 2011). The specific instruments used by the performer and the acoustic features of the venue lend a specific sound quality which also contributes to the emotional expressiveness of the music (Konečni, 2010). These extra nuances which are not expressed in the score (Gabrielsson, 2009), are referred to as "low-level parameters" (Baraldi *et al.,* 2006). Some contemporary musical styles can express very high arousal factors because of modern instruments, amplification and production techniques (Holochwost & Izard, 2008).

### *Spatial Qualities of Sound*

Levetin (2006) proposes that the spatial location has a mentionable effect on the emotional meaning of music. The listener determines spatial location of different sound sources by determining the amount of reverberation, the volume balance between instruments and the left/right (stereo) placement of the sound.

> Recording engineers and musicians have learned to create special effects that tickle our brain by exploiting neural circuits that evolved to discern important features of our auditory environment (Levetin, 2006:107).

The spatial quality of sound is also of importance in acoustic performances, where the room would provide reverberation and the placement of players on stage would determine a stereo image. However, in such a performance setting, the control over these factors is much more limited than in a multitrack recording setup. It should be kept in mind that most contemporary music is strongly dependent on the recording and production techniques used, and this will have a considerable impact on the expressiveness of the music, in much the same way as all the performance features mentioned above will have.

### *Enjoyment and Music Preference*

The enjoyment and preference of music can be decisively subjective (Juslin & Västfjäll, 2008). Enjoyment may be influenced by the context – venue, appearance, presence and technical skill of the performer/s and quality of the specific performance (Gabrielsson & Juslin, 1996; Scherer & Zentner, 2001). Sometimes, elements in the music can influence a person's enjoyment such as excessive bass, or whininess of a melodic instrument, or the balance between simplicity and complexity of the music (Levetin, 2006). These are meta-emotions of the music and influence the effectiveness of emotional induction (Rozin & Rozin, 2008).

The mood induced by a piece of music does not necessarily influence the enjoyment of the music (Hussein *et al.,* 2002). One can enjoy a sad piece of music (Rozin & Rozin, 2008). However, people tend to prefer happy-sounding music, unless they are already feeling sad (Hunter & Schellenberg, 2010).

*Genre*

It can be argued that certain musical styles lend themselves better to the expression of certain emotions. An example is that heavy metal music is theoretically an ideal conveyer of anger in music because of harsh timbres, typically very loud performance and fast, irregular rhythms. Likewise, classical music can theoretically communicate lower arousal emotions like serenity well because of generally smooth timbres and textures (Gabrielsson & Juslin, 1996; Zentner & Eerola, 2010). However, a listener who highly favours a specific genre will be accustomed to the different modalities inside that genre, and hence a heavy-metal enthusiast may not find the music particularly anger provoking while a listener to classical music may recognise both low and high arousal emotions in the music.

*Familiarity*

> Safety plays a role for a lot of us in choosing music. To a certain extent, we surrender to music when we listen to it (Levetin, 2006:242-243).

The familiarity of a piece or style of music will influence the enjoyment of the music by the listener because our familiarity with a piece or style of music plays an important role in our ability to form expectations about the music. A new, unfamiliar piece of music is still forming certain schemata and may initially be rejected, but after a few hearings, the schemata are formed and the listener may now enjoy the music. The piece of music will tend to be enjoyed more when it is somewhat familiar, because the music is much more predictable, and the brain rewards accurate prediction (Huron & Margulis, 2010). But, after a sufficient number of exposures to the music, the listener finds no new challenge in the music, and may then reject the music again. Many styles of popular music have considerable literal repetition, promoting quick familiarity with the music (Holochwost & Izard, 2008). However, after a few hearings the music will become too familiar, the challenge of prediction drops, and the music becomes boring (Levetin, 2006).

According to Meyer's theory (1956), a piece of music in an unfamiliar style would be totally without meaning. It can be imagined that a listener who is not accustomed to *avant garde* compositions would find it very hard to make any sense of a musical piece in this style. Conversely, in the context of commercialised film for example, certain musical styles are prevalent and the regular viewer will be accustomed to the general emotional associations

of music. Film music will therefore be very effective at recalling emotions because the regular viewer would be accustomed to these emotional associations. Meyer's theory then contradicts statements made by other authors that music of different cultures can be distinguished reliably.

*Complexity*

The structural simplicity *vs.* complexity of music has a profound effect on the number of times the listener needs to hear the music in order to recognise structural patterns and form predictions and hence the amount of listening needed to become familiar with the piece or style of music (Levetin, 2006; Juslin & Västfjäll, 2008; Holochwost & Izard, 2008; Hunter & Schellenberg, 2010).

When a musical piece is rather complicated, the listener needs more time to understand the musical concepts and needs some time to form expectations. This will also ensure that the listener does not become bored with the music easily and instead develops awe for the profound composition. It can however happen that music becomes too complex for the listener to comprehend, and this may cause a total rejection of the music. Jazz music, for instance, is not so easily comprehended, hence many people's rejection of the style. On the contrary, when musical structures are too predictable, the music becomes robotic and will soon be deemed unexciting, causing the listener to become bored with the music. The music is then described as being simplistic (Levetin, 2006). Some examples of electronic dance music contain very little musical content, and are therefore rejected by listeners after only a few number of listenings. This may explain why musically untrained people would tend to prefer simple popular or folk music for example, while musically trained persons who are able to understand more complicated musical structures would appreciate more complex styles of music (Juslin & Västfjäll, 2008).

The composer thus has to strike a healthy balance between simplicity and complexity in order for the listeners in the target market to enjoy the music (Levetin, 2006; Juslin & Västfjäll, 2008). An often-used graphic explanation is the inverted-U graph, showing that very high or very low levels of originality/complexity result in music that is unpopular, while a balanced level of complexity normally ensures high popularity of the music (Simonton, 2010). The inverted-U graph is also applicable to the familiarity factor of music.

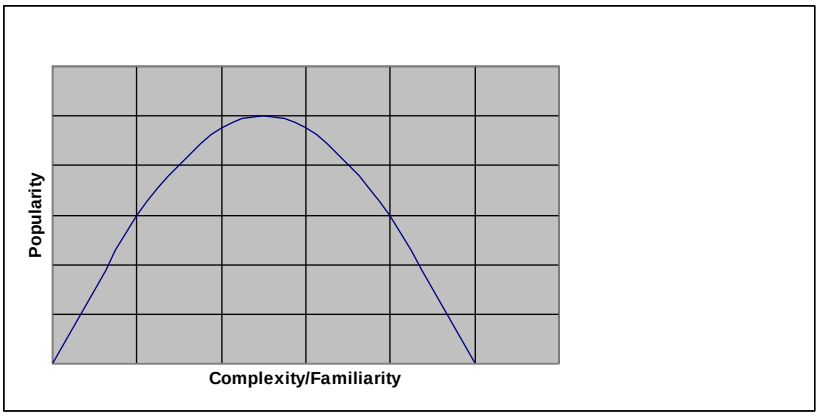


*Fig. 7. The inverted U-graph showing the relation between either structural or complexity familiarity* vs. *popularity of music (adapted from Simonton, 2010).*

### *Form*

Global musical structures showed very little in terms of expressiveness (Gabrielsson & Lindström, 2010).

## *THE ADDITIVE EFFECT OF STRUCTURAL FACTORS*

It should by now be obvious that the musical-emotional experience relies on the combination of many different structural cues to instil different emotions in the listener (Scherer & Zentner, 2008). However, it was proposed by Juslin & Lindström that different structural factors can influence one another. They conducted empirical tests to determine the effect of interaction between structures. No complicated interactions were found, except that some features slightly enhance the effect of other features. Rather, structures work together in an additive fashion, instead of an interactive process. It was also found that certain structures contribute significantly more to certain emotions. This makes it possible to reliably control the type and extent of emotion represented by the music. (2010).

To create and test musical samples on listeners in different combinations of all structural possibilities would be absurdly complicated (Juslin & Lindström, 2010), but at least the structures can be investigated individually. Specific structures that have received little or no attention in research will be investigated in the next chapter.

# CHAPTER FOUR

# EMPIRICAL TESTS ON MUSIC AND EMOTIONS

## *DESCRIPTION OF THE EMPIRICAL TEST*

The last sub-aim of this dissertation proposes that existing gaps in the research of musical structures and their emotive qualities should be supplemented through empirical tests. According to Gabrielsson (2009) there exists very little systematic research on the role of specific musical structures in the creation of emotional perception, specifically melodic and rhythmic progressions, and in particular harmonic progressions.

In order to fulfil this sub-aim an empirical test was devised, working as follows:

For each musical structure under investigation, a group of musical excerpts was composed. Each excerpt within the group explored different possible attributes of the specific structure. Within the group, the musical excerpts remained identical as far as aesthetically possible, with only one parameter – the relevant structure – being changed. These compositions were presented to test participants, who judged the excerpts according to a list of emotions.

Verbal instructions to test participants were recorded and compiled together with the musical examples. Each group of examples were played twice. The whole test was thus presented as a recording, eliminating the complications of having to train a facilitator. The complete soundtrack lasted about 50 minutes, allowing the test to comfortably fit into an hour period. Depending on the group of participants, the test was paused from time to time to answer questions and to regain the participants' concentration.

The test participants received an answer sheet to fill in. For each group of excerpts, the answer sheet contained a list of possible emotional adjectives. The participants were asked to write the emotion detected next to the relevant excerpt number. The participants were prompted to write additional emotions, should the emotion detected not be present in the box. An opportunity for additional comments was given at the end of the answer sheet.

A consent form was handed to all participants stating the background of the project and clearing all terms and conditions. The participants were asked to sign the form. This form

was collected separately from the answer sheets. The only personal information requested on the answer sheets was the age of each participant.

*METHODOLOGICAL STRENGTHS AND WEAKNESSES*

The degree of accuracy to distinguish basic emotions relies on the type of test and method of evaluation, the style of music and the specific piece of music used (Juslin & Lindström, 2010).

The method of measurements in such quantitive tests could have an influence on results. For instance, tests measuring the recognition of basic emotions normally show strong evidence that people can accurately distinguish emotions in music because basic emotions are easily discernible. Contrarily, in tests that allow for the measurement of more complex emotions where the variation in emotional nuances is much wider, larger differences in results will occur (Vieillard *et al.,* 2011). Furthermore, because of personal differences among listeners, for example difference in musical preference, results of such tests will not be so accurate among listeners (Juslin & Västfjäll, 2008; Zacharopoulou & Kyriakidou, 2009). The study by Zacharopoulou & Kyriakidou (2009) also found that people experience emotions in different degrees of intensity.

Trehub (2008) is concerned that most tests that compare musical emotion with specific musical structures have a small list of intended emotions in an adjective checklist from which the participants could choose one option. This has the advantage of helping participants who are less fluent in verbalising their emotional state. Participants may however misinterpret the adjectives, or they might experience an emotion that is not presented on the checklist (Zentner & Eerola, 2010). This method often results in overwhelmingly coherent responses being reported.

The test compiled for this research uses the method mentioned above because of its practical feasibility. It was considered a methodological strength to use a concrete quantitive empirical test that provides clear answers to an otherwise ambiguous and flimsy field. Unfortunately the obvious limitations of a study like this is that it can only account for basic emotions. To prevent participants from misinterpreting the adjectives, a separate sheet explaining some difficult words were circulated. All participants were well affiliated with

English despite the fact that very few participants had English as mother tongue. The limitation of the closed adjective list as described was addressed by stating to the participants that they may write a word that they think fits the music better next to their answers if this word was not presented as an option. Some participant seemingly missed this statement, and wrote exactly about this problem in the section for additional comments.

An alternative method of evaluation would have participants indicate their experienced emotion on a scale of valence and on a scale of arousal. The researcher can then locate the corresponding emotions as represented in the Valence x Arousal Model (Zentner & Eerola, 2010). This is an interesting approach, but was foreseen to be practically more complicated to execute because participants would not be used to thinking about emotions in terms of activity and valence. The approach was, however, applied in some examples, where participants had to rate the music as either “lively” or “lazy” (arousal) as well as “happy” or “sad” (valence). The approach also inspired the approach to the final data analysis, where closely-related emotions were grouped together, and where results gathered around these related emotions. The outcome was discussed according to the valence/arousal influence of the music. The disadvantage of this approach is that certain emotions like “romantic” are very unique, and its meaning would get lost.

Whereas open-ended responses provide the best way to get true responses from participants, it would create many unique responses making it difficult to really pronounce the results as coherent (Scherer & Zentner 2001; Scherer, 2004). This was not considered a viable option because of the obvious methodological challenges. However, this may be a very plausible method for a researcher who is interested in the subjective effects of music on listeners. Still, space for additional comments in this test provided some valuable additional information that might otherwise not have cropped up in a quantitive test.

Concerning the construction of tests investigating the effect of music on the brain, Levetin (2006) believes in the use of “real” music (i.e. live presentations or recordings of actual pieces), opposed to examples composed specifically for the test at hand. His reason for this approach is that the mind should respond to the music as it would do in real-life situations, as opposed to being fired with pitchless rhythms, or rhythmless pitches for example. The problem with using ‘real’ music for such tests is that musical features are so intertwined that

their individual effects cannot be tested (Juslin & Lindström, 2010), but Levetin (2006), although admitting the difficulty in assessment of response to specific musical elements, states that good planning of music to be used in these tests will ensure successful measurements. Juslin & Västfjäll (2008) further believes that music and emotion should be studied in real-world situations, and not in clinical laboratory settings, for the obvious reason that people respond to the stimulus differently when it occurs as part of their lifestyle. This would then give better understanding to the working of the different induction mechanisms. There are obvious practical difficulties in conducting such research.

Care was taken to compose musical examples for this test that contain rhythm, melody and harmony, so that the specific structures are not taken out of musical context. To avoid boredom, different instrumentation and styles of music (Scherer & Zentner, 2001) were employed, using a mix of MIDI and live recorded instruments. Compositional styles varied between classical, rock and hip-hop. Even the key signatures were varied with the purpose of variety and the avoidance of boredom.

Scherer & Zentner (2001) point out that many of these typical musical examples used for such tests are in the idiom of Western classical music, neglecting other styles and cultures of music. It should be considered that in the modern day, the mass consumption of music is in styles other than the classical styles. This difficulty was overcome through the above mentioned use of other styles of music. Unfortunately, this brought along another problem: Some participants mentioned that it was more difficult to ascertain the emotional content of the music containing drums because the drums provided extra and unnecessary auditory information.

It was suggested that a lower age restriction on participants for this test be imposed since younger children may have a weaker ability to discern the emotional content of the music (Alcorta *et al.*, 2008). The restriction was not in place for the test, hence all age groups were allowed to participate. Only in the capturing and evaluation of the test data was a lower age cut-off point of 14 years introduced. Facilitators noted that most children below this age struggled to complete the test, and all participants below this age marked the test as “difficult.” Still, more than 90% participants were between 14 and 18 years of age. The relatively young mean age is seen as advantageous. It was found that adolescents are most

receptive to the emotional effects of music (Alcorta *et al.*, 2008). Furthermore, musical styles are continuously evolving. Research results obtained from this age group will remain relevant longer in applications of music where emotion is important, for example in film and pop music.

The tests were presented to extra-curricular music theory students and to scholars with class music as a subject. The advantage of this group is that their basic involvement in music gives them a somewhat better ability to aurally distinguish musical attributes than totally untrained listeners, possibly rendering more concrete test results (as totally untrained listeners may not be able to discern the small differences presented in some example). Contrarily, the group (except for three participants who were music teachers) were also not yet professional musicians who might have been too analytical about the music.

Presenting the test as an audio recording has the methodological advantage of ensuring that all the tests are presented exactly alike. It also eliminates possible influences by the study leader, who can create the so-called "Researcher Expectancy Effect," where he may consciously or unconsciously make known to the participants what the expected results should be (Mouton, 2001). Mouton further points out that sometimes participants develop an impression of what the 'correct' answer should be, and they answer accordingly, instead of providing their subjective answer. This is called "Demand Characteristics" In an attempt to avoid this problem, statements on the answer sheet were added to prompt participants to answer according to their "gut feeling," that there are "no right or wrong answers" and that their answers remain anonymous.

### *COMPOSED MUSICAL EXCERPTS*

It was decided that this test would explore mostly melodic and harmonic attributes. Because of limitations it was not possible to investigate the effects of rhythm (however melodic and harmonic rhythm were investigated). As a "pilot" test for rhythmic elements, the effect of time signature was included in this test. A list of composed groups of music with brief explanations is presented below. Please refer to Annexure 1 to view the compositions.

A. *HARMONY:*

Group 1: Cadences

A simple melody with four-part accompaniment is presented as an introduction. Fragments containing the different cadences are then presented, consisting of a perfect cadence, a plagal cadence and two interrupted cadences. The extra interrupted cadence ensures more harmonic variety, which could imply more variety of emotions. The imperfect cadence is omitted as it contains the same chords as the perfect cadence; the only difference lies in the expectation and the anticipated resolution, which would evoke different emotions in the context of the whole song than when it is presented in a stand-alone context.

Group 2: Chord Quality

Major and minor triads and major, dominant and minor seventh chords are presented with a functional melody.

Group 3: Inversions *vs.* Root-Based Harmony

In traditional classical harmony, the importance of flowing continuity between different voices, including the bass line, is normally emphasised. This practice is often not applied in popular and rock music. It is hypothesised that the flow of voices and bass line have different emotional meaning from the 'block chord' and root bass approach more typical of contemporary popular music. The example is presented in a classical style. Three basic binary options are presented as emotional choices.

Group 4: Chord Progressions: Major

One progression contains a mixture of the basic chords, one plays around with the subdominant and related supertonic and submediant minor chords, another with the dominant and related mediant minor chord. Then, one progression employs a harmonic sequence while the last one makes a quick modulation to the related minor.

Group 5: Chord Progressions: Minor

As with the previous group, an attempt was made to select progressions with specific attributes.

Group 6: Two-Chord Progressions

This test presents diatonic chords in relation to the tonic.

The combination of chord progression in harmonic context as cadences and in isolation, provides a triangulated approach to determine the effect of chords in emotional responses.

Group 7: Harmonic Rhythm

Harmonic rhythm, like melodic rhythm, is hypothesised to contribute to emotional arousal. The binary emotional choices will indicate the influence on arousal ("lively" or "lazy") as well as the influence, if any, on valence ("happy" or "sad").

B. *MELODY*

Group 1: Interval Sizes: Major

Group 2: Interval Sizes: Minor

Group 3: Interval Sizes: Chromatic

It is hypothesised that interval sizes can have an influence on emotional arousal. They are explored as large, intermediate or small interval sizes in major key (positive emotions), minor key (negative emotions) and chromatic (very negative emotions).

Group 4: Melodic Rhythm

A melody is adapted with varied amounts and types of melodic rhythm. It is hypothesised that melodic rhythm could contribute to emotional arousal.

Group 5 & 6: Diatonic Intervals: Major

Group 7 & 8: Diatonic Intervals: Minor

In groups 5 and 6 as well as groups 7 and 8, two functional melodies are adapted to contain certain diatonic intervals. This is specifically incorporated in the test because the intervals are put into a melodic context.

Group 9 & 10: Specific Intervals

A functional melody is adapted to contain specific intervals.

The last three groups were too long to present as a single group and were thus divided into smaller groups.

C. *TIME SIGNATURES*

Group 1: Time Signatures

A melody is adapted from 4/4 into 6/8 and 3/4 time signatures. The effect of time signature is largely univestigated, hence two binary choices for each adaptation is given. This should give an outcome according to valence x arousal.

## *EXECUTION*

Three venues were used in which to conduct the tests: Two small classrooms and one large classroom. Appropriate sound playback systems (Alesis 520 USB monitor speakers for the smaller rooms and a larger fixed P.A. for the large room) connected to personal computers hosting the audio files were utilised. The tests were presented to extra-curricular music theory students at the College of the Arts in Windhoek, Namibia and to class music scholars from the *Deutsche Höhre Privatschule* also in Windhoek, Namibia. The two music theory lecturers at the COTA agreed to facilitate the test for their students. The study leader facilitated the tests at the DHPS with the help of the school's music teacher. The answer sheets of a total number of 52 participants were captured. The sheets of three participants under the age of fourteen were discarded. All papers were copied double-sided to save paper.

## *DATA CAPTURING AND MANIPULATION*

The answers were captured on capturing sheets with tally marks indicating the amount of participants that indicated a specific adjective for each musical example. The totals were loaded on a Microsoft Excel spread sheet with charts indicating the amount of marks scored for each musical example.

Some difficulties were experienced during the capturing process. In some cases, participants did not write all numbers corresponding to the musical examples in a group. The total

number of marks scored per musical example across different emotions is therefore not always consistent for all the examples. In other cases participants marked more than one number per adjective. The binary answers were often misunderstood.

## *DISCUSSION*

The test revealed how, and to what extent, different emotions are communicated to a listener through the manipulation of certain musical structures.

### *SECTION A: HARMONY*

#### *Cadences*

Indications were found that a perfect cadence is interpreted as somewhat positive (neutral and happy being the most popular choices). The plagal cadence showed lower activity ratings than the perfect, with neutral valences. The interrupted cadence to chord *vi* had "longing" as the most popular choice. This makes sense as this cadence leads the music into a different direction, in this case the minor, as the theme was presented purely in the major mode. The interrupted cadence to the *#iv* diminished chord reliably evoked "fear" as a response and was anticipated because of existing findings surrounding dissonance.

#### *Chord Quality*

Clear indications were found that establishes the major triad as "happy," the major $7^{th}$ chord as "peaceful," the dominant $7^{th}$ as "bored" (the distinction between "bored" as a low activity negative emotion and "boring" as in a dislike of the music should be noted) and the minor triad as "sad." The minor $7^{th}$ showed negative valence emotions, but did not single out a specific emotion.

#### *Voice Leading vs. Block Chords*

Block chords showed more active and positive results ("happy," "lively" and "triumphant") than voice-lead progressions ("sad," "romantic" and "lazy").

*Chord Progressions in Major*

"Happy" was tested when only primary chords were used in a progression. Subdominant chords (*IV*, *vi* and *ii*) indicated slightly more positive qualities ("peaceful") than dominant chords (*V* and *iii*), which was voted "serious." The ascending harmonic sequence indicated "majestic." It should be noted that the results in this Group 4 were very ambiguous and varied.

*Chord Progressions in Minor*

Again the results were too varied to be of much scientific value. The only strong indication was the harmonic sequence which was voted as "heroic." The progression using the dominant minor chord was indicated as "sad."

*Two-Chord Progressions*

This test isolated chords and compared them with a single tonic in a major mode context. The example using the dominant chord was indicated "dreamy" and the subdominant as "neutral." These two results come as a slight surprise since it does not match the results of the same chords as used in the cadences test. Further, the mediant was predominantly marked as "sad" and the submediant as "peaceful." The use of only the tonic chord was expectedly marked as "bored" while the one chromatic chord was, as anticipated, marked with negative and high arousal adjectives ("fearful" and "angry"). The supertonic minor chord did not single out any emotion, but was marked mostly with negative emotions.

*Harmonic Rhythm*

Fast harmonic rhythm indicated positive valence and high arousal while slow harmonic rhythm indicated negative valence and low arousal.

*SECTION B: MELODY*

1, 2, 3. Interval sizes

In the examples using major and minor modes the effect of interval sizes demonstrated that larger intervals relate to high activity emotions while small intervals relate to low activity

emotions However, in the example using the chromatic melody, suspense – which is regarded as a lower activity emotion compared to anger – was experienced with large interval sizes, even though the difference in votes were marginal.

### *Melodic Rhythm*

The answers indicate that melodic rhythm corresponds to the perception of emotional arousal, where fast melodic rhythm was associated with high arousal emotions. The example containing syncopations did not show a clear distinction from the one containing regular fast melodic rhythm.

### *Diatonic Intervals in Major*

In this test, 3rds, 4ths, 5ths, 6ths and octaves were all marked with higher arousal descriptions. 2nds and 7ths were of lower arousal. Unisons were mostly marked as "bored."

### *Diatonic Intervals in Minor*

Octaves and unisons were surprisingly marked with very negative emotions like "disgust" and "anger." This differs from other findings as summarised in Annexure 5, therefore the distinction "repeated octaves and unisons" were included in the summaries since this description fits the melodies used in this tests. 2nds were marked as "majestic" while 7ths were considered "serious" and 3rds as "dignified" and "serious." 6ths showed stately emotions like "romantic" and "majestic."

### *Specific Intervals*

Unison was strongly rated as "bored" and perfect $5^{th}$ as "neutral." Other tendencies were the minor $2^{nd}$ rated as "shame" (probably the best description for a very negative emotion with fairly low arousal), the minor $3^{rd}$ as "angry," the tritone with very negative emotions like fear, anger and shame and the minor $6^{th}$ as "sad." Both major $3^{rd}$ and perfect $4^{th}$ showed relatively high ratings "peaceful."

It should be noted that the last three interval tests suffered a methodological weakness; namely that each test was initially too long to be viable in this context. They were all split

into smaller tests with different adjectives, but the results were then published in the same graph.

*SECTION C:*

*Time Signatures*

The musical example reworked into 4/4, 3/4 and 6/8 could be rated by participants using two binary options reflecting valence and arousal factors. The 4/4 version was rated low arousal but neutral valance with adjectives such as “lazy” and “content,” while the 6/8 was strongly rated “lively” and “happy,” i.e. positive and active. The 3/4 was characterised by negative valence and low activity.

*PRESENTATION OF RESULTS*

Summaries of findings relating to musical structures and their association to specific emotions as found through research and through the empirical test described in this thesis are published in Annexure 5. Findings through research were taken from Bharucha (1984), Gabrielsson & Juslin (1996), Livingstone & Thompson (2006), Oelmann & Laeng (2009), Gabrielsson & Lindstrom (2010) and Juslin & Lindström (2010).

# CHAPTER FIVE

# CONCLUSION

Most studies of musical structures and emotion focus only on local aspects of music. This includes the lengthy investigations into the emotional attributes of music in the preceding two chapters. Researching the effect of these local structures is most vital, as they are the building blocks of music. However, there are still a number of musical structures that are under investigated. For example, rhythmic patterns are foundational to all musical styles and are extremely important in contemporary genres like rock and dance music. Yet, not many researchers have included detailed studies of these musical structures in their research. Even some musical structures that have been investigated, for example intervals, have not yet provided clear usable results. If more researchers investigate these fields through different types of tests, more clarity will emerge and useful results may be published. Musical structures that specifically need investigation are timbre, texture, time signature and rhythmic patterns.

Despite the fact that the local effects of musical structures on the emotional meaning of a piece of music can provide good directions for the composer, they tend to be elusive, and a given "rule" will not always be applicable. The effectiveness of the composition relies more on the skill of the composer, because many features are dependent on each other and have some degree of interaction (Juslin & Lindström, 2010). The action-perception theory of Vickhoff & Malmgren (2004) provides a good answer, because according to this theory, the composer would subliminally use the appropriate structures correctly to convey an intended emotion. Still, knowledge on the local effects of musical structure would serve as a guideline for the composer.

Once a comprehensive understanding of the effects of individual musical structures have been established, it would be necessary to research how the construction of larger sections adds to the overall emotional meaning of the music (Meyer, 1956). Discussions of the effect of melodic, harmonic and rhythmic use in specific musical examples by authors like Meyer (1956) and Vischer (1987) are extremely valuable in this regard, but the authors did not provide us with a framework that classifies these patterns.

It is thus recommended further that, apart from completing research on the local effects of all musical structures, future research should focus on the effect and development of larger architectonic sections of the music. Whereas quantitive tests and experiments investigating the effect of local and isolated structures can be easily carried out, tests focusing on larger sections of music will most likely be more qualitative in nature.

Finally, it should be considered that music moves over time, and is a process instead of an object (Meyer, 1956). Collective structural features working in smaller and larger sections of the musical work make intricate contributions to this process (Oelmann & Laeng, 2009). This musical process often depicts different characters, mixed emotion and ambiguous responses. These different integrated representations contribute to an overall deep and pleasing emotional journey (Bicknell, 2009). Any person attempting to label music according to emotional attributes will soon find it very difficult to put rules in place that will work reliably for all compositions, especially across different musical genres. Music is a complex phenomenon and, as with the holistic human emotional experience, can be very evasive and undeniably subjective. Therefore all research on this great topic will not result in more than mere guidelines that will be challenged and stretched with every new composition.

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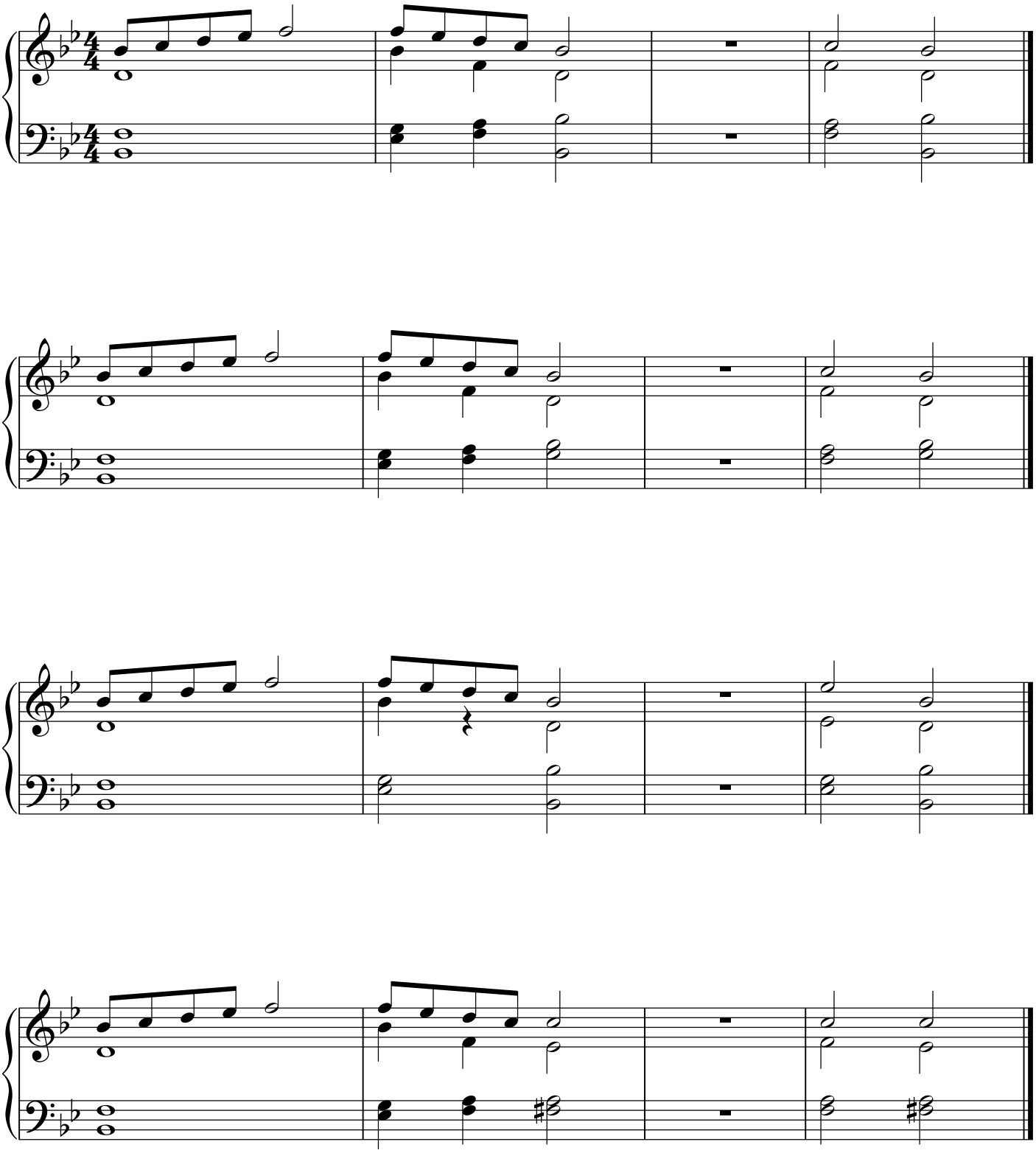
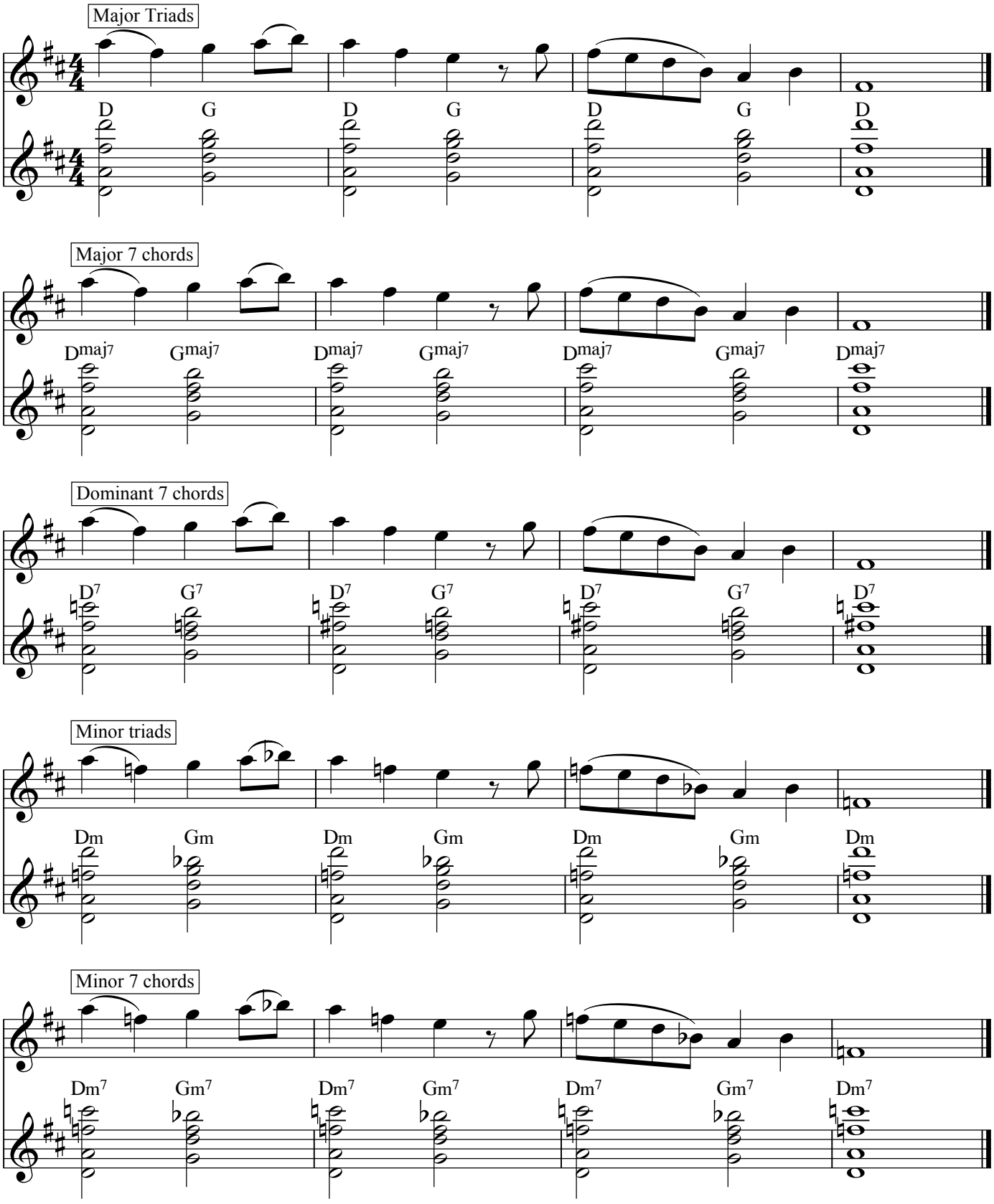
ANNEXURE 1
SHEET MUSIC USED FOR EMPIRICAL TESTS

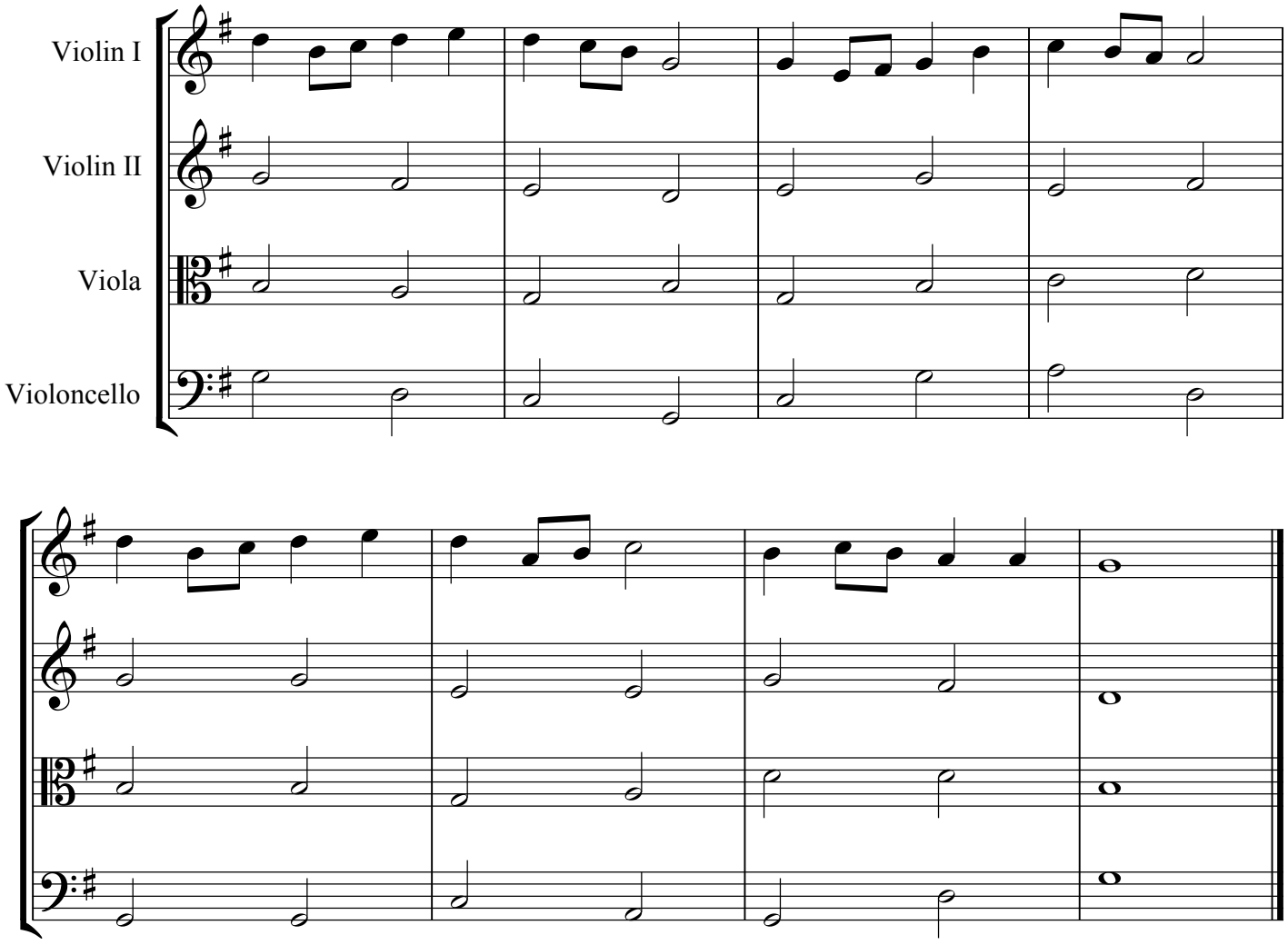
# A1: Cadences

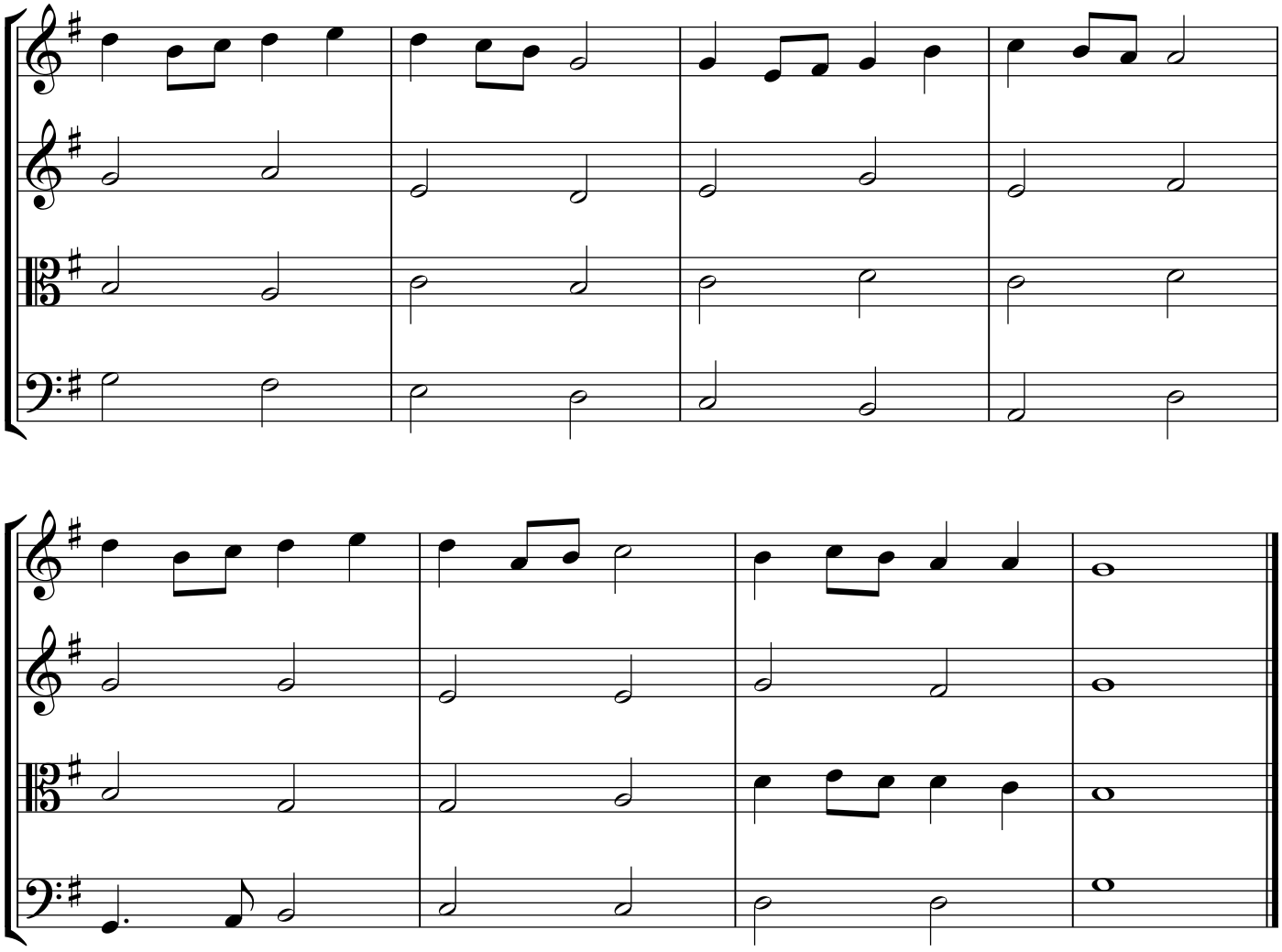


# A2: Chord quality

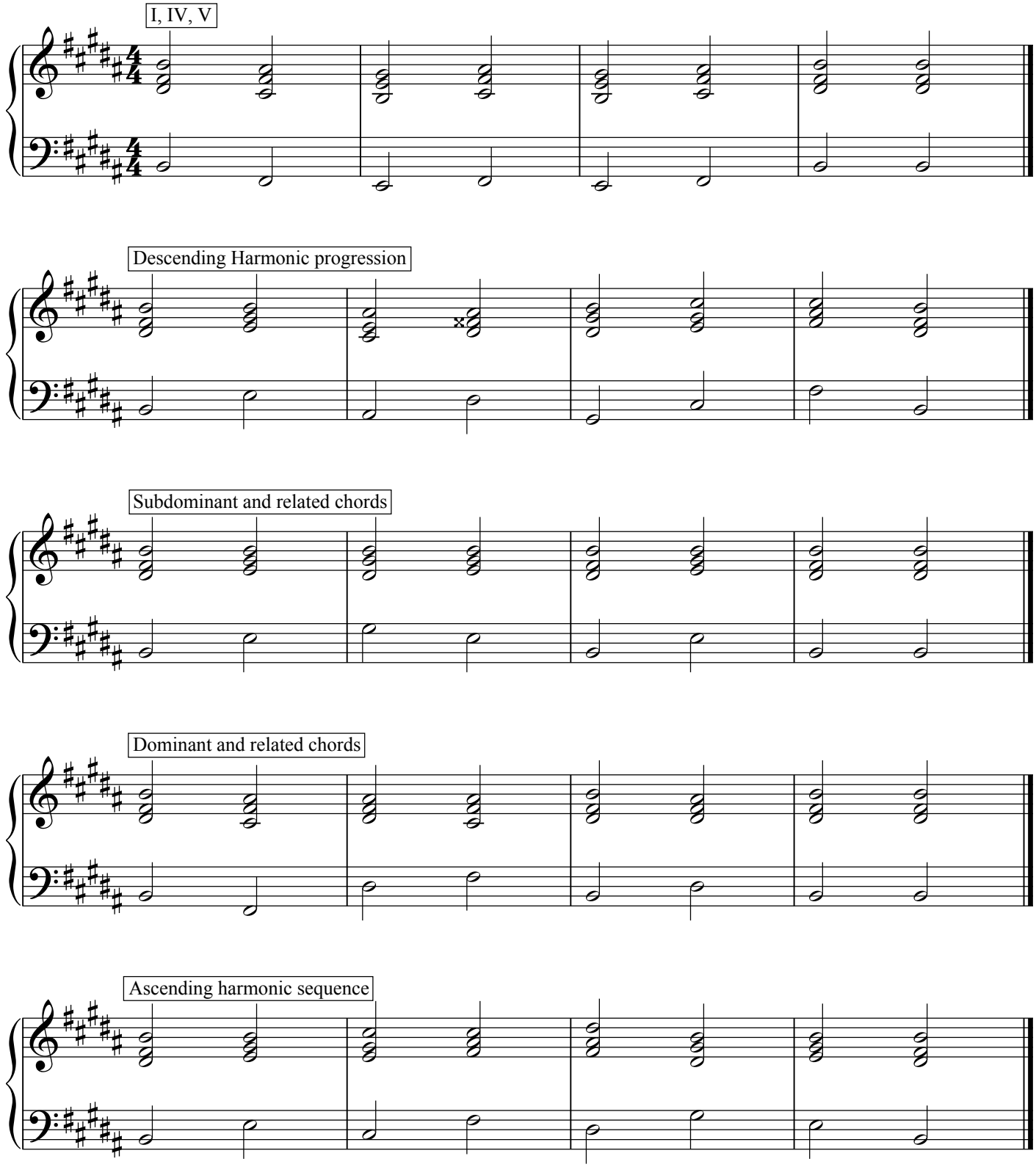


# A3: Voice leading *vs.* block chords

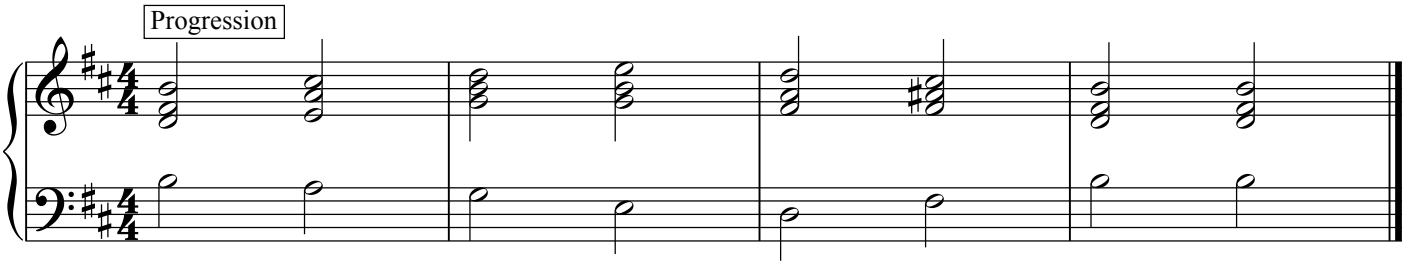


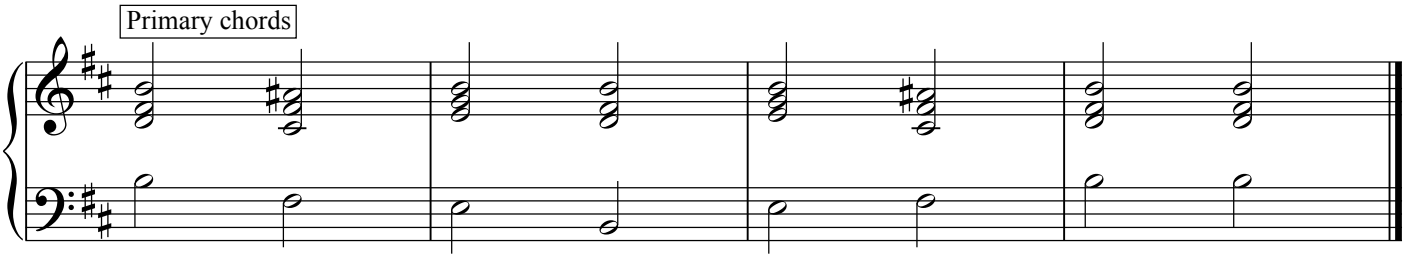


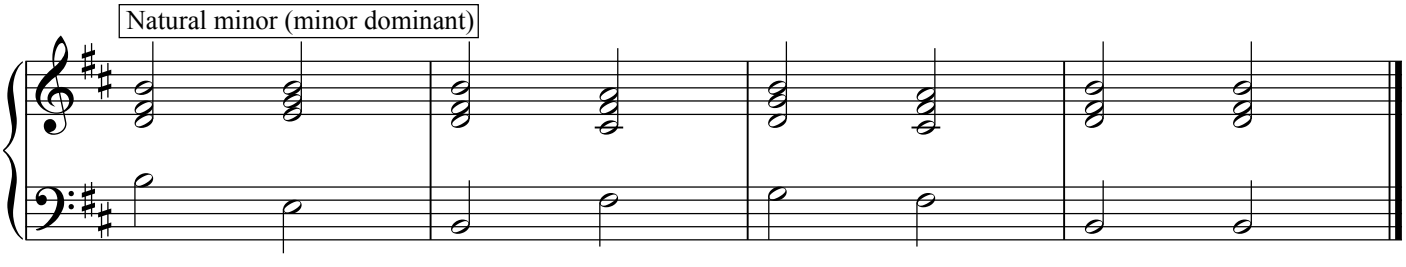
# A4: Chord progressions in major

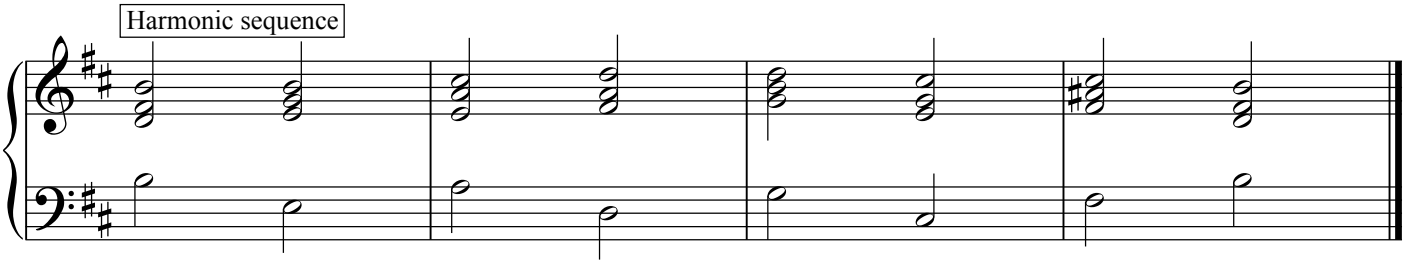


# A5: Chord progressions in minor

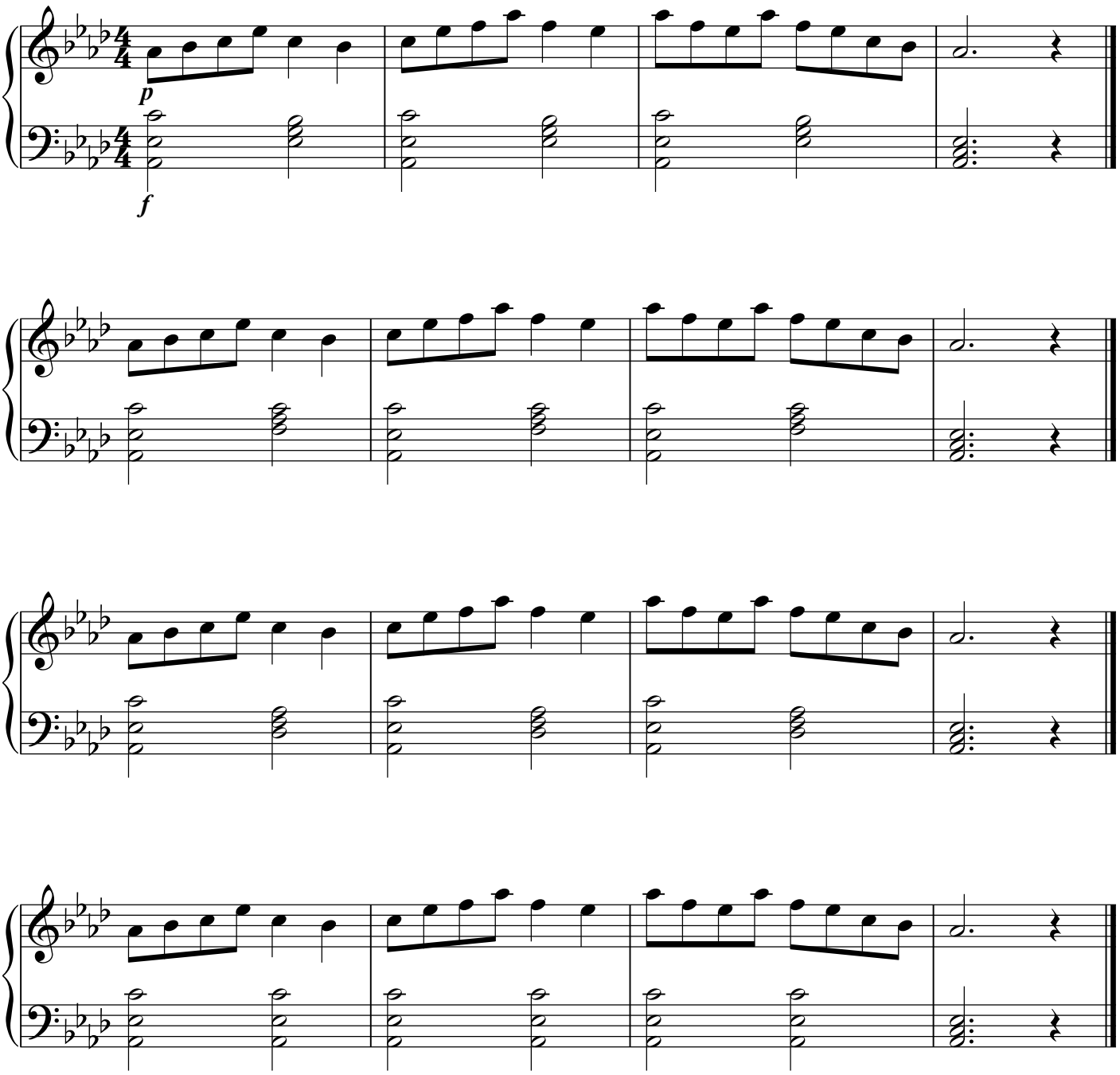


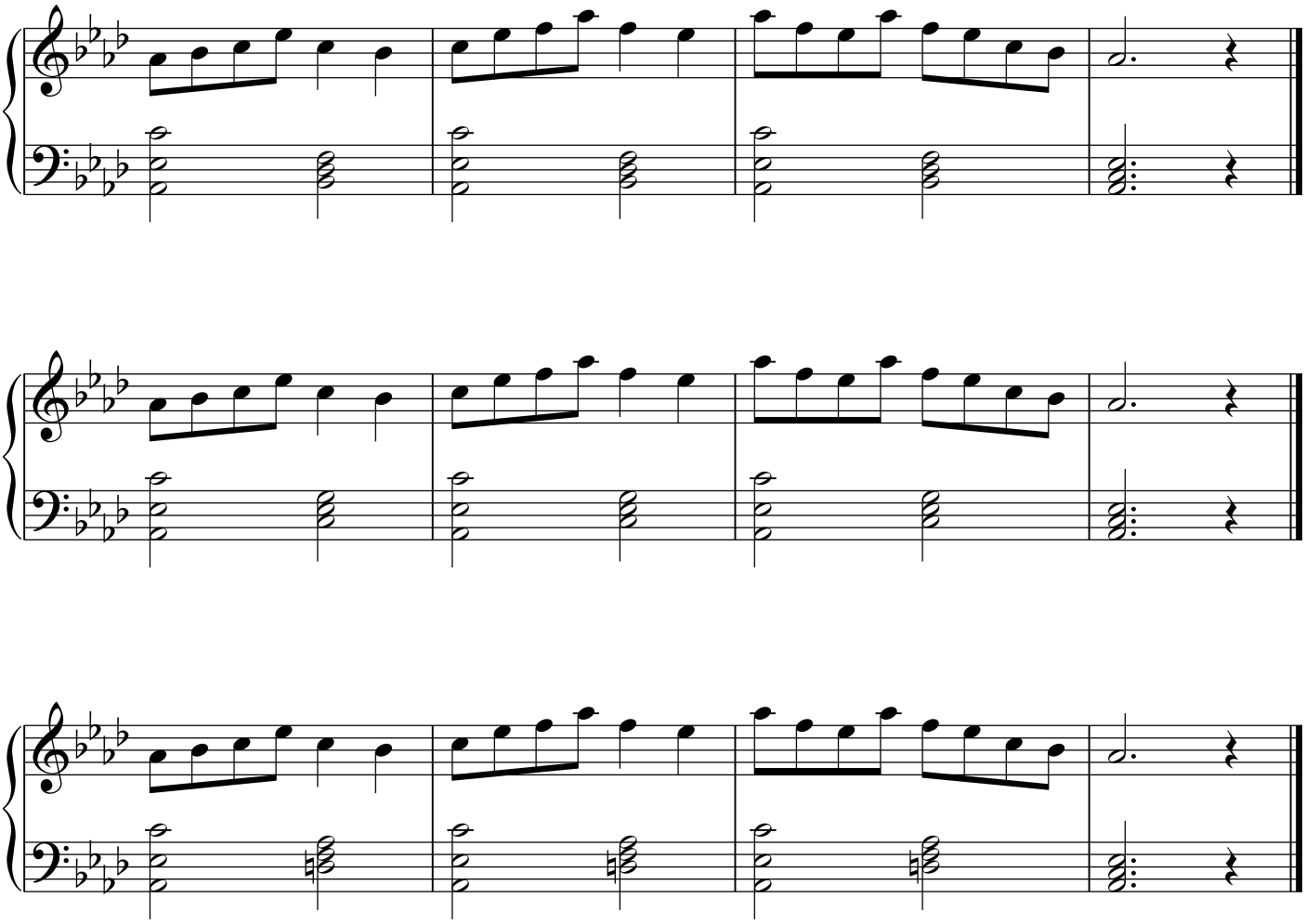



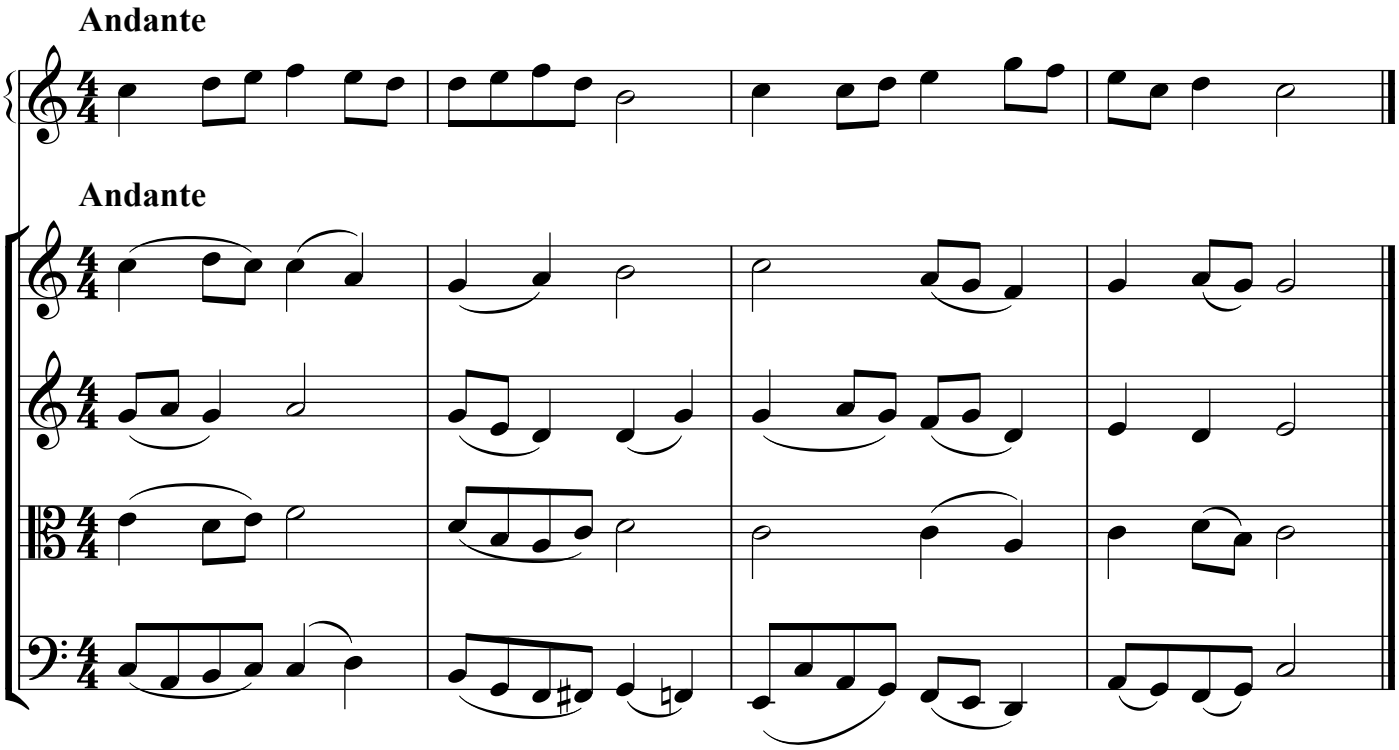



# A6: Two-chord progressions



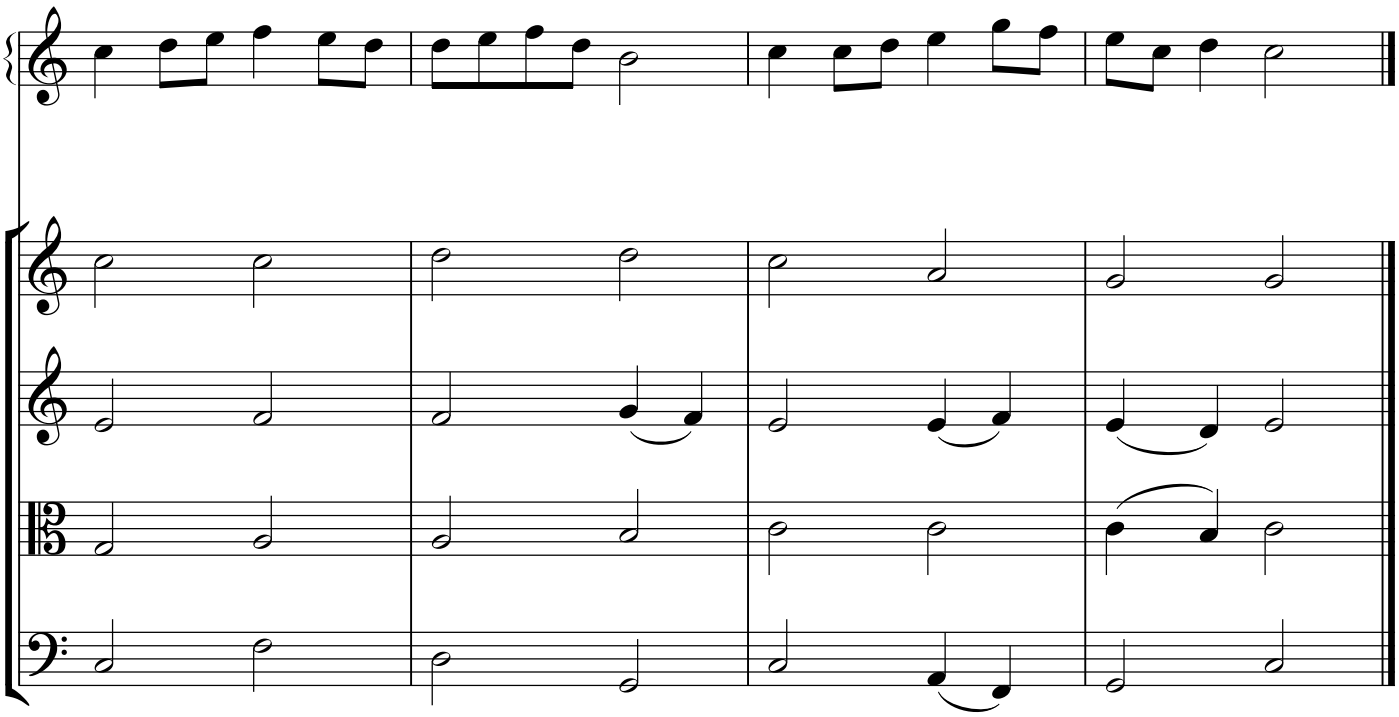


# A7: Harmonic rhythm

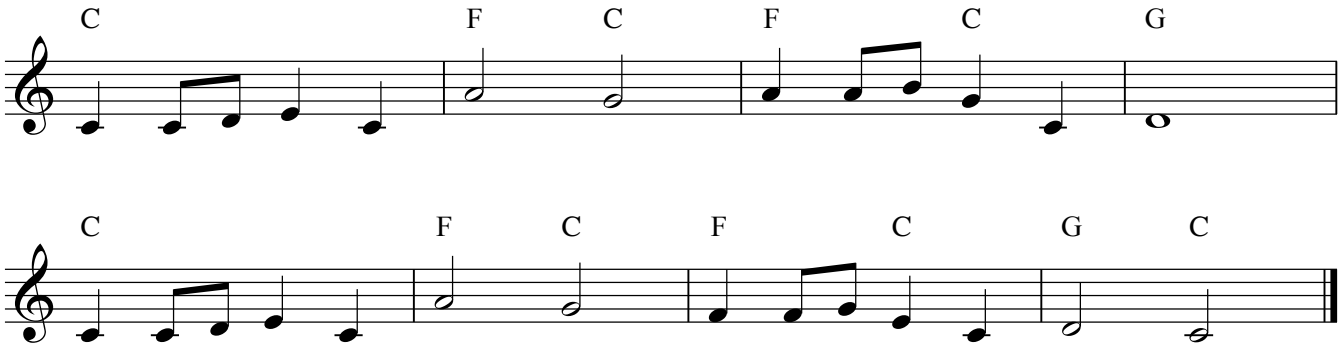






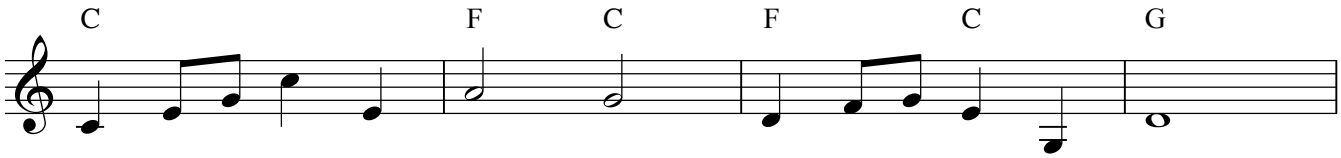


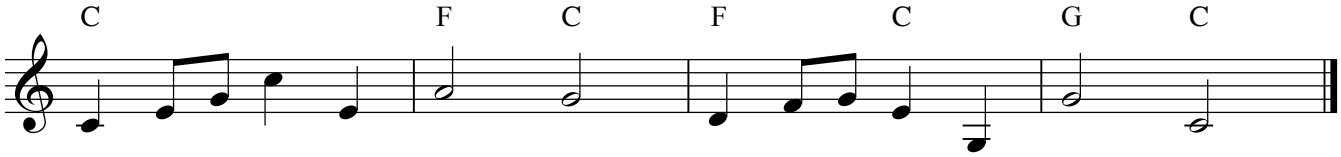
# B1: Interval sizes - major

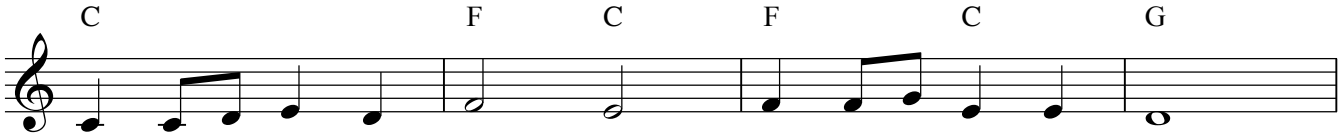


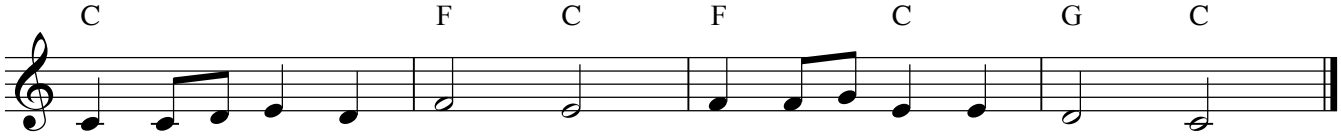




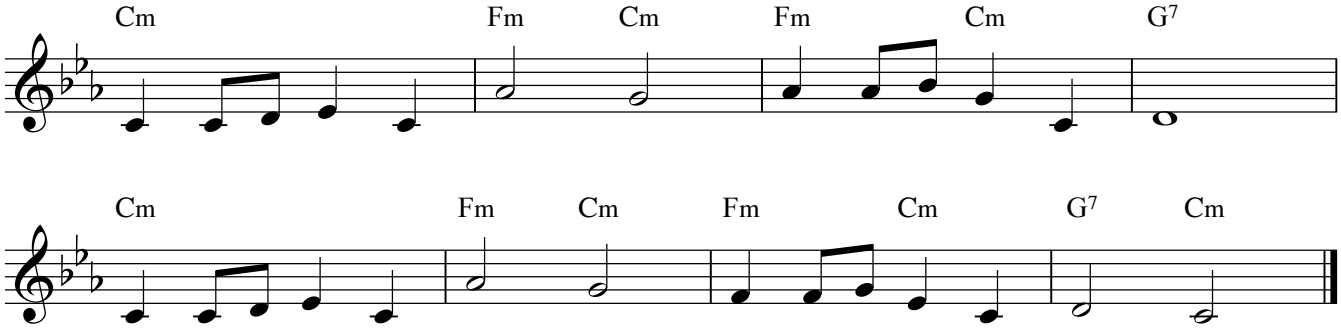


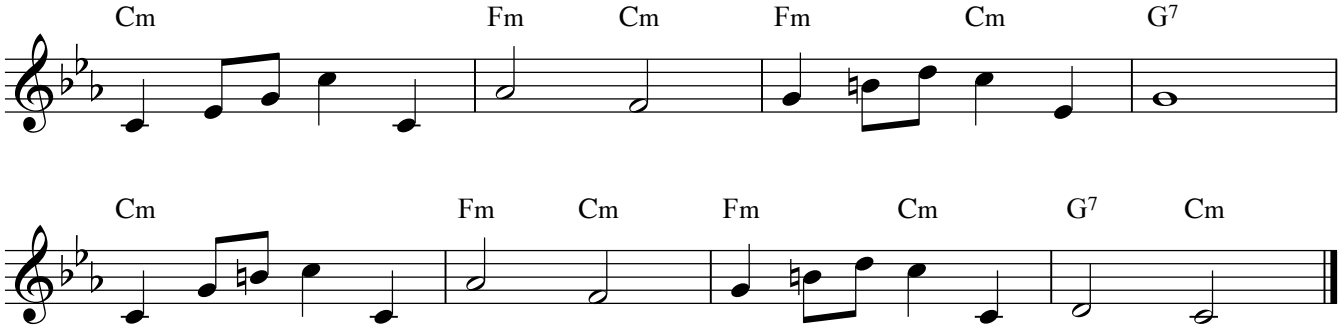



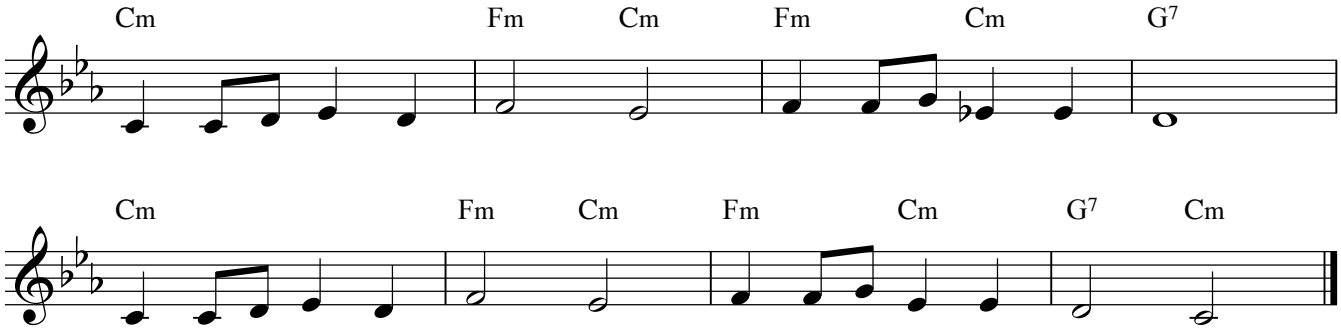



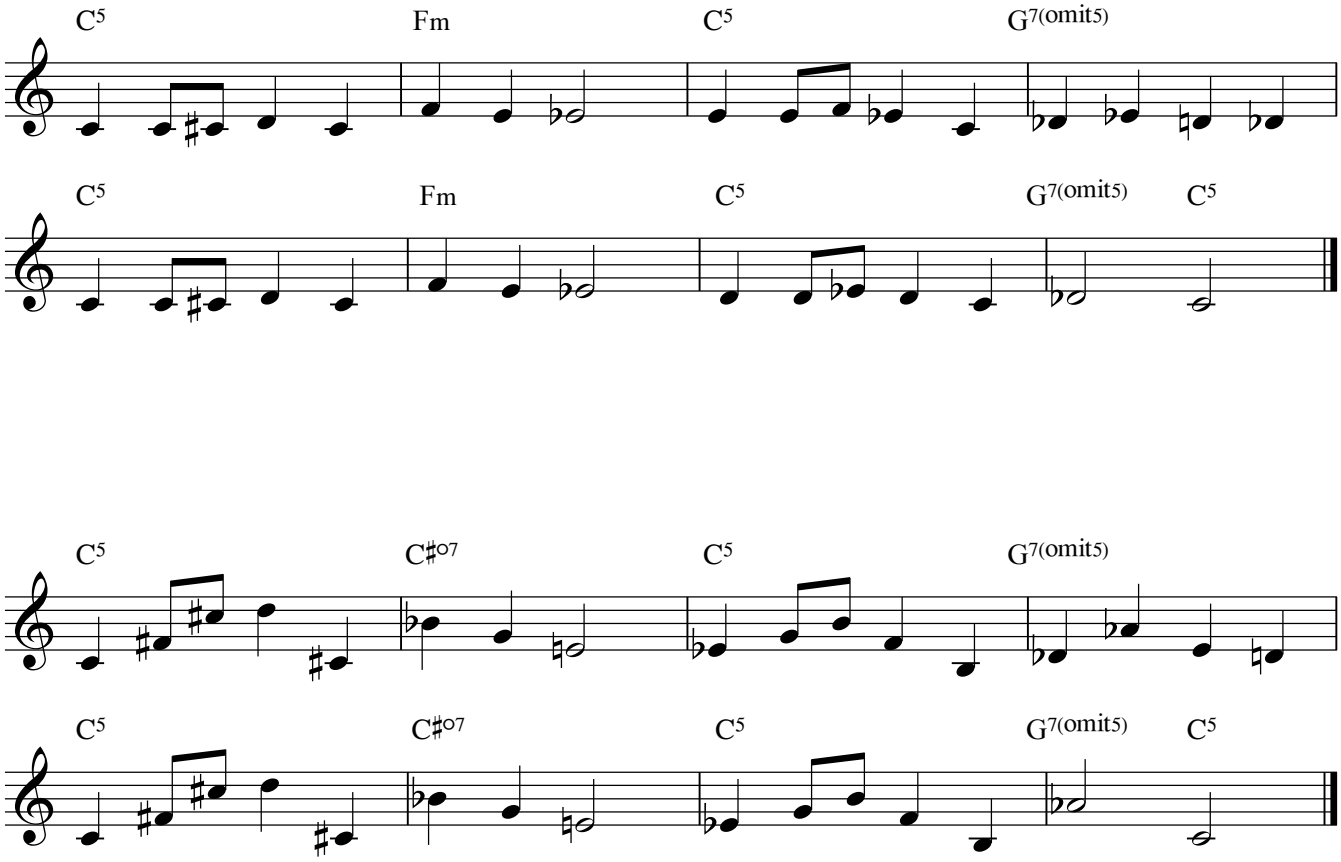
# B2: Interval sizes - minor



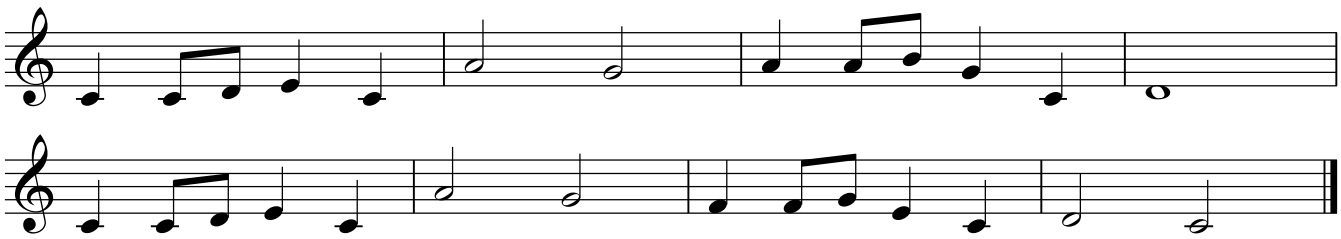



# B3: Interval sizes - chromatic

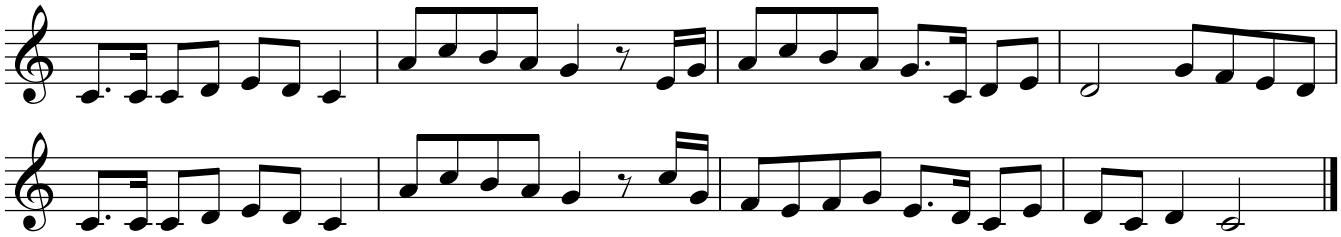


# B4: Melodic rhythm

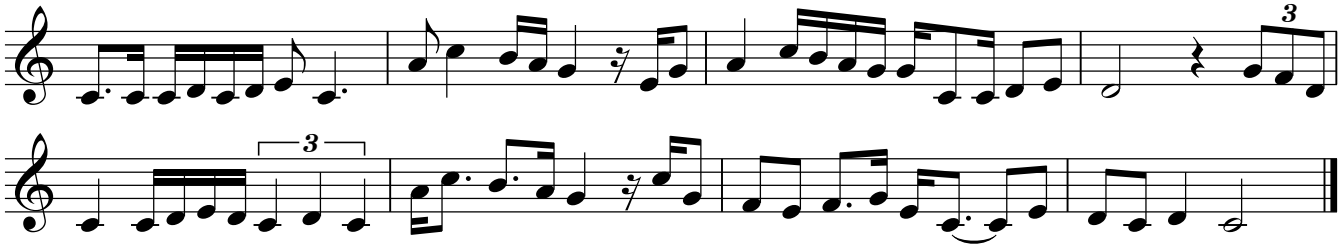
STANDARD



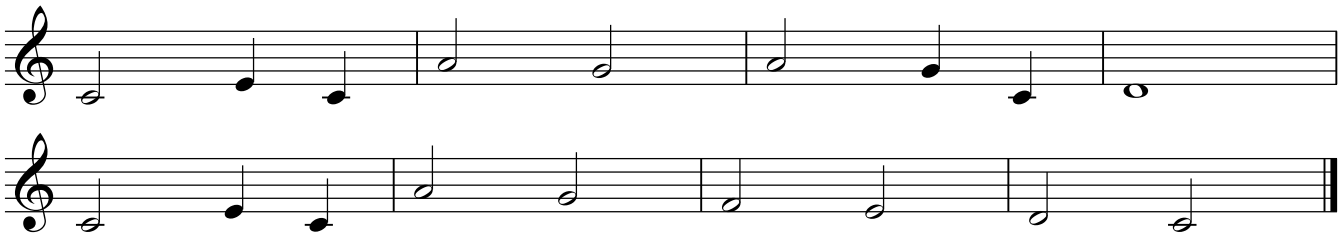
FAST, REGULAR



FAST, IRREGULAR



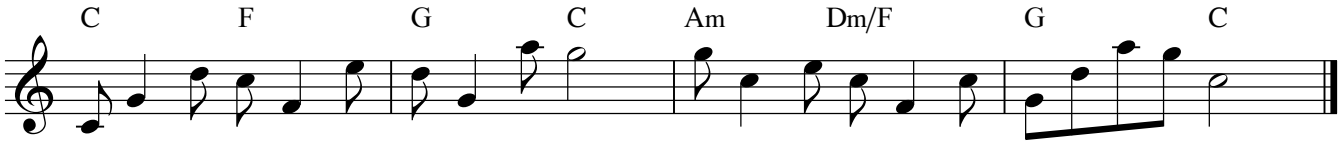

SLOW



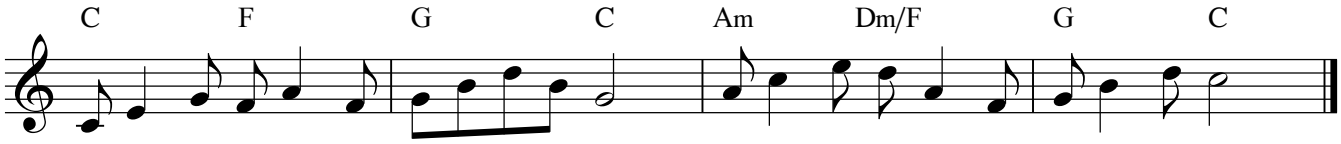
# B5: Diatonic intervals
# - major

FIFTHS

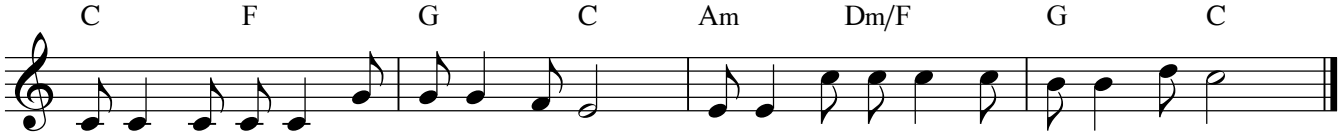
GROUP 5



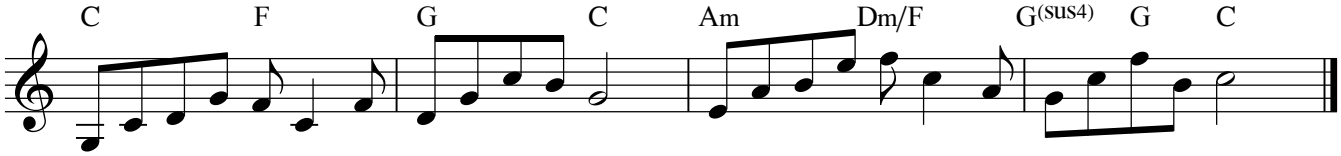

THIRDS




UNISONS



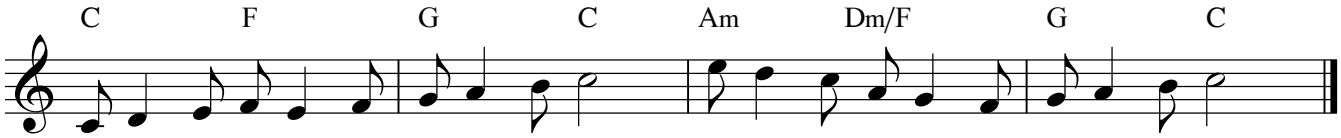

FOURTHS



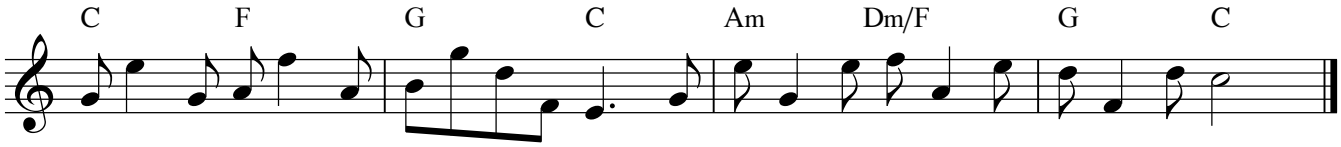
# B6: Diatonic intervals
# - major

GROUP 6

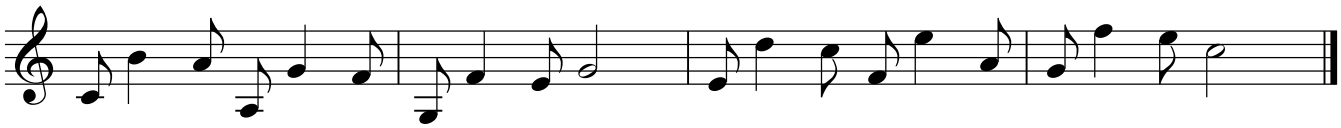
SECONDS



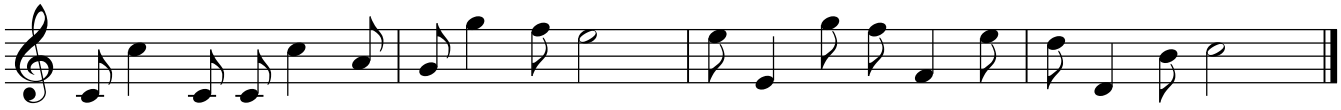

SIXTHS



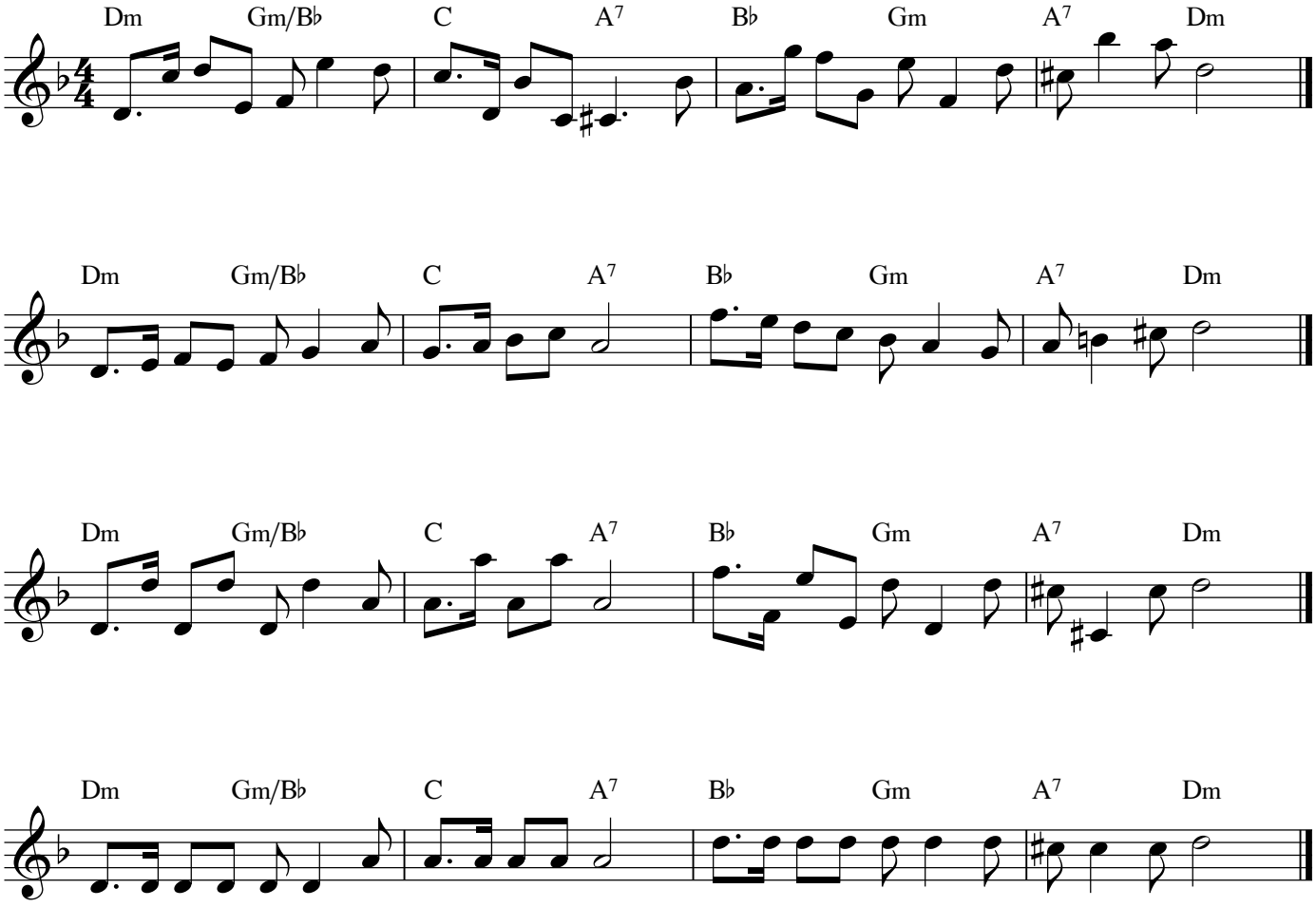

SEVENTHS



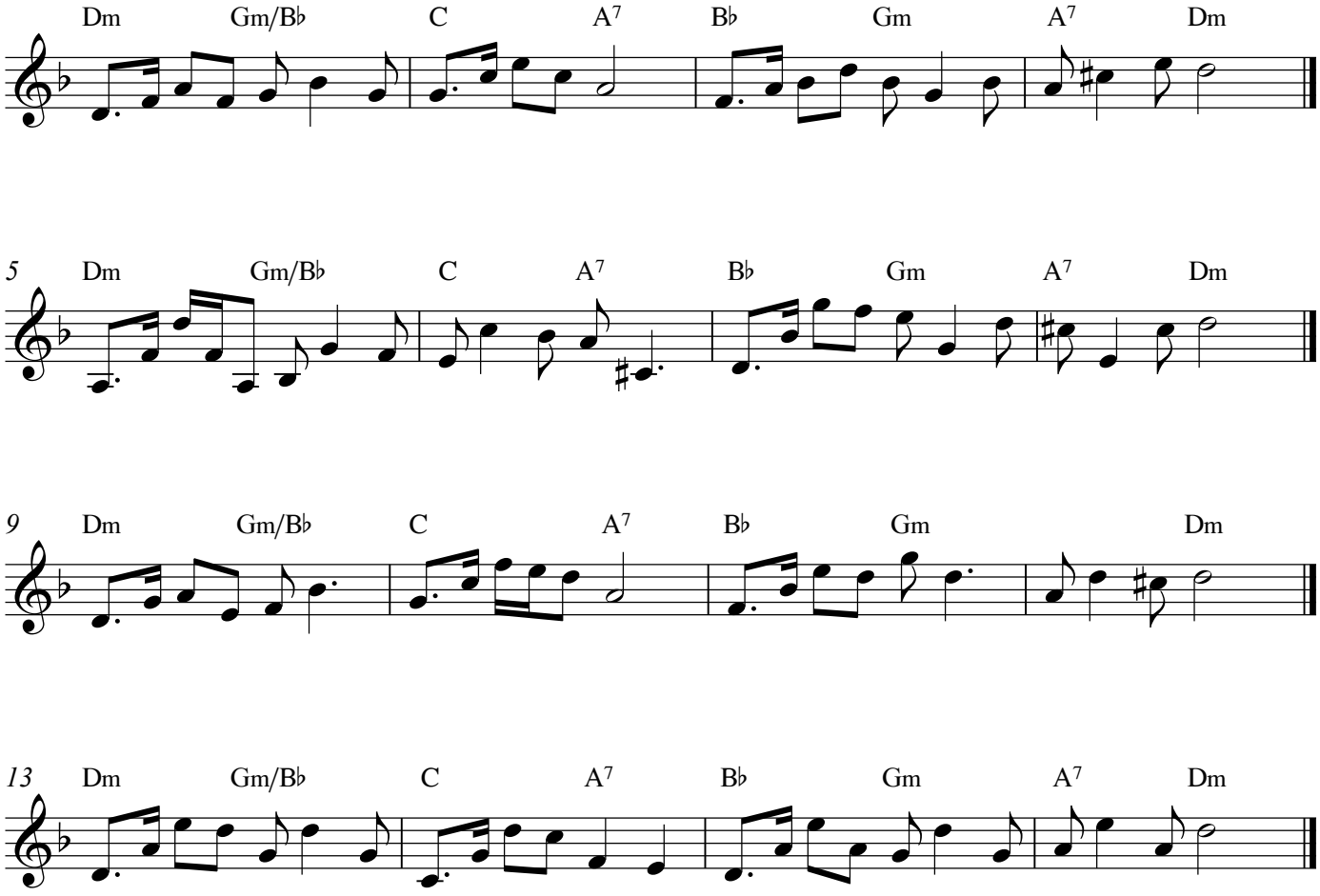
OCTAVES



# B7: Diatonic intervals
# - minor

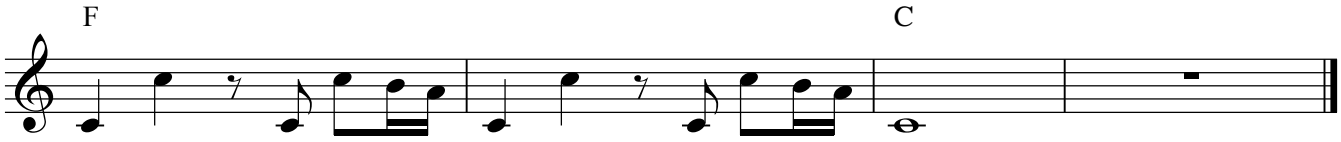


# B8: Diatonic intervals
# - minor

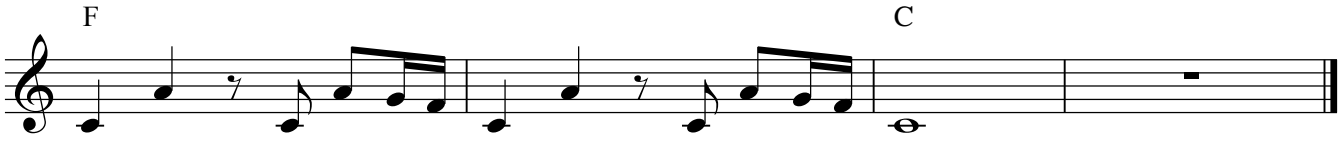


# B9: Specific intervals

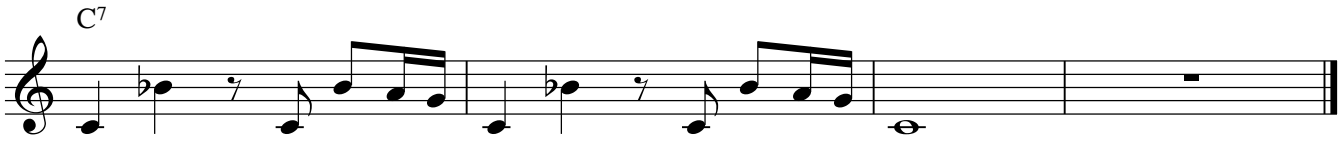
OCTAVES



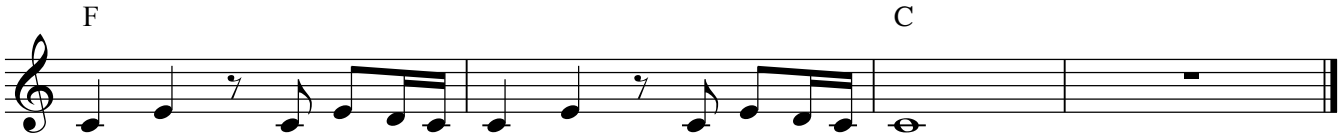

MAJOR SIXTHS



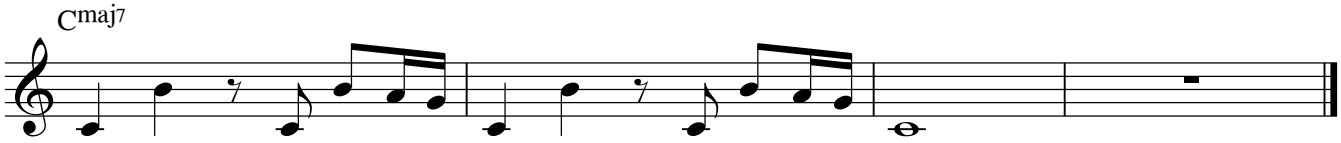

MINOR SEVENTHS



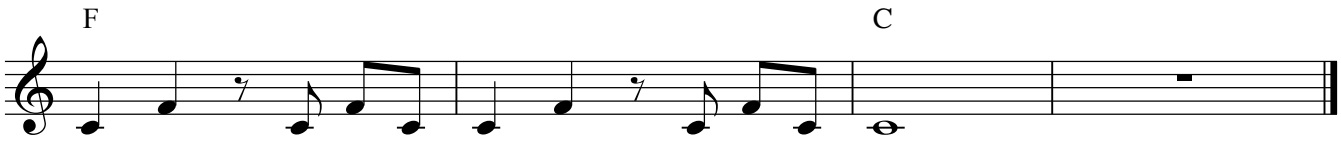

MAJOR THIRDS



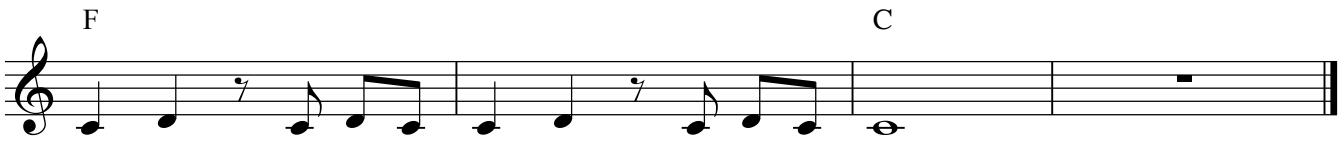

MAJOR SEVENTHS




PERFECT FOURTHS

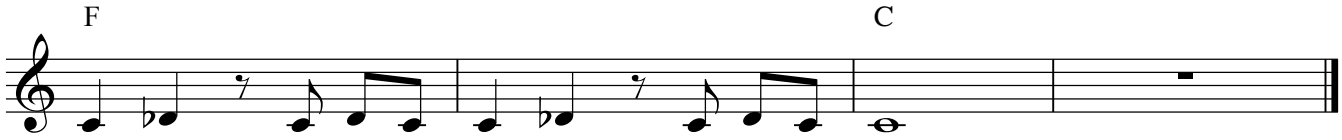



MAJOR SECONDS

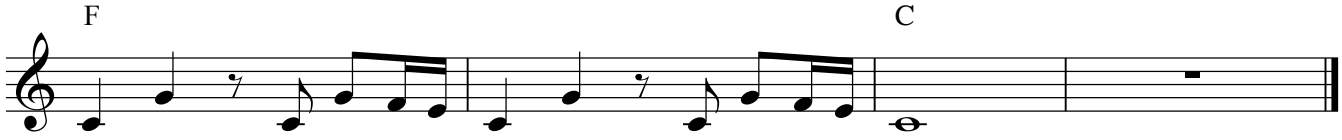


# B10: Specific intervals

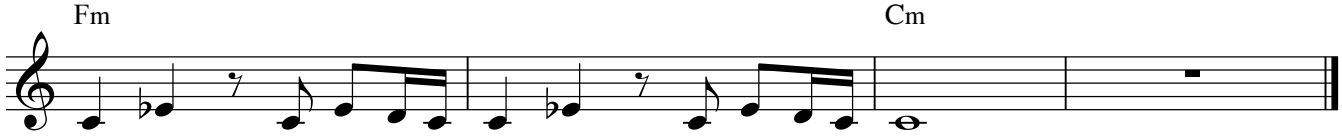
MINOR SECONDS



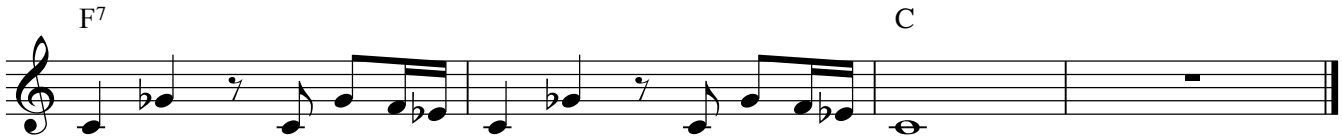

PERFECT FIFTHS



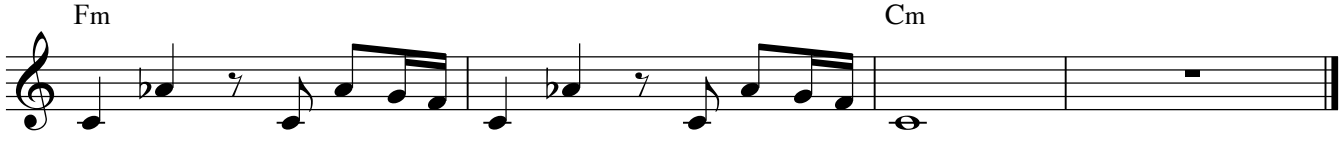

MINOR THIRDS



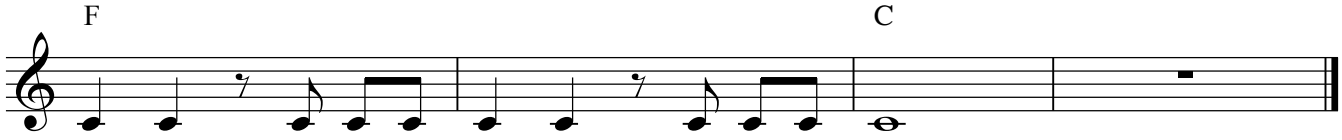

TRITONES



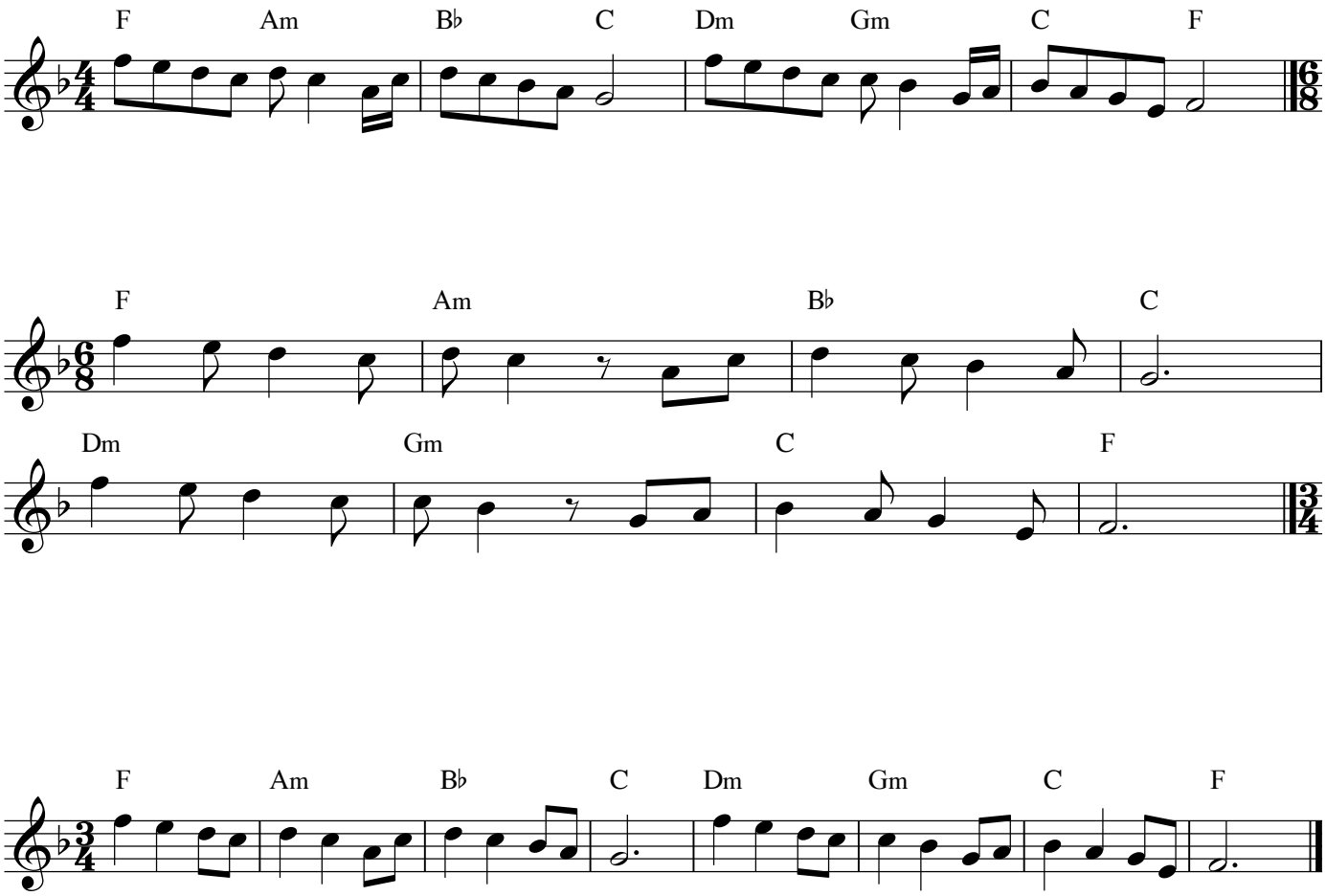

MINOR SIXTHS




UNISONS



# C1: Time signatures



ANNEXURE 2
ANSWER SHEET FOR EMPIRICAL TESTS

# AURAL TEST FOR MUSIC AND EMOTION

Welcome to this test! Please write down your age: _____

You will now be presented with some pieces of music. The music will be presented in groups corresponding to the indications on this answer sheet.

- Each group on your answer sheet contains a box with emotions words like the example shown. Listen to the group of musical pieces, and mark lightly with pencil which emotion word fits that piece of music the best. The group of musical pieces will be played again. This time, check your existing answers and write down your final answer.

| EMOTION WORDS: | NUMBER: |
|---|---|
| Neutral | _____ |
| Happy | _____ |
| Playful | _____ |
| Bored | _____ |

- In some cases there will be more than one box with emotions words for the group, as this next example shows. In these cases you have to write down the numbers of the musical pieces in *all* the different boxes.

| EMOTION WORDS: | NUMBER: |
|---|---|
| Lively | _____ |
| Lazy | _____ |
| Happy | _____ |
| Sad | _____ |

- It will often be difficult to distinguish between the emotions portrayed by the music. Don't let this discourage you. Just listen carefully to the subtle differences, and mark the word that you think fits best. Remember that there are no right or wrong answers! Just answer according to your 'gut feeling.'
- If you think the music portrays an emotion that is not listed in the box, you are welcome to write that word down with the number of the piece of music next to your answer.

Here we go!

**SECTION A:**

| Group 1* | |
|---|---|
| **EMOTION WORDS:** | **NUMBER:** |
| Sad | _____ |
| Scared | _____ |
| Happy | _____ |
| Neutral | _____ |
| Longing | _____ |
| Peaceful | _____ |

*Group 1 has only 4 musical pieces, but 6 possible answers. You only have to provide 4 answers and leave two blank spaces.

| Group 2* | |
|---|---|
| **EMOTION WORDS:** | **NUMBER:** |
| Happy | _____ |
| Peaceful | _____ |
| Bored | _____ |
| Sad | _____ |
| Disgust | _____ |
| Dignified | _____ |

*Group 2 has only 5 musical pieces, but 6 possible answers.

| Group 3** | |
|---|---|
| **EMOTION WORDS:** | **NUMBER:** |
| Lively | _____ |
| Lazy | _____ |
| Happy | _____ |
| Sad | _____ |
| Triumphant | _____ |
| Romantic | _____ |

**Group 3 has two pieces of music and three boxes. Write answers in all three boxes.

| Group 4 | |
|---|---|
| **EMOTION WORDS:** | **NUMBER:** |
| Peaceful | _____ |
| Majestic | _____ |
| Expectant | _____ |
| Serious | _____ |
| Happy | _____ |

| Group 5* | |
|---|---|
| **EMOTION WORDS:** | **NUMBER:** |
| Disappointed | _____ |
| Gloomy | _____ |
| Heroic | _____ |
| Nostalgic | _____ |
| Sad | _____ |

*Group 5 has only 4 musical pieces, but 5 possible answers.

| Group 6* | |
|---|---|
| **EMOTION WORDS:** | **NUMBER:** |
| Peaceful | _____ |
| Dreamy | _____ |
| Sad | _____ |
| Angry | _____ |
| Neutral | _____ |
| Fearful | _____ |
| Bored | _____ |
| Happy | _____ |

*Group 6 has 7 musical pieces, but 8 possible answers.

| Group 7** | |
|---|---|
| **EMOTION WORDS:** | **NUMBER:** |
| Lively | _____ |
| Lazy | _____ |
| Happy | _____ |
| Sad | _____ |

**SECTION B:**

| Group 1 | |
|---|---|
| **EMOTION WORDS:** | **NUMBER:** |
| Excited | _____ |
| Calm | _____ |
| Happy | _____ |

| Group 2 | |
|---|---|
| **EMOTION WORDS:** | **NUMBER:** |
| Sad | _____ |
| Bored | _____ |
| Majestic | _____ |

| Group 3 | |
|---|---|
| **EMOTION WORDS:** | **NUMBER:** |
| Suspense | _____ |
| Anger | _____ |

| Group 4 | |
|---|---|
| **EMOTION WORDS:** | **NUMBER:** |
| Content | _____ |
| Happy | _____ |
| Playful | _____ |
| Calm | _____ |

| Group 5 | |
|---|---|
| **EMOTION WORDS:** | **NUMBER:** |
| Content | _____ |
| Excited | _____ |
| Playful | _____ |
| Happy | _____ |

| Group 6 | |
|---|---|
| **EMOTION WORDS:** | **NUMBER:** |
| Happy | _____ |
| Romantic | _____ |
| Content | _____ |
| Triumphant | _____ |

| Group 7 | |
|---|---|
| **EMOTION WORDS:** | **NUMBER:** |
| Serious | _____ |
| Angry | _____ |
| Majestic | _____ |
| Disgust | _____ |

| Group 8 | |
|---|---|
| **EMOTION WORDS:** | **NUMBER:** |
| Serious | _____ |
| Romantic | _____ |
| Majestic | _____ |
| Dignified | _____ |

| Group 9 | |
|---|---|
| **EMOTION WORDS:** | **NUMBER:** |
| Happy | _____ |
| Content | _____ |
| Triumphant | _____ |
| Joyful | _____ |
| Romantic | _____ |
| Dreamy | _____ |
| Peaceful | _____ |

| Group 10 | |
|---|---|
| **EMOTION WORDS:** | **NUMBER:** |
| Neutral | _____ |
| Fearful | _____ |
| Angry | _____ |
| Bored | _____ |
| Shame | _____ |
| Sad | _____ |

**SECTION C:**

| Group 1** | |
|---|---|
| **EMOTION WORDS:** | **NUMBER:** |
| Lively | _____ |
| Neutral | _____ |
| Lazy | _____ |
| Happy | _____ |
| Content | _____ |
| Sad | _____ |

**Group 1 has three pieces of music and two boxes. Write answers in all three boxes.

Lastly, please indicate whether you found this test easy, difficult or moderately difficult to complete. Also write any additional comments you may have about the test.

| Easy | Moderate | Difficult |
|---|---|---|

**Additional comments (if any):**

_____

_____

_____

_____

University of Cape Town
Faculty of Humanities

**CONSENT FORM FOR PARTICIPATION IN THE STUDY CALLED**

**"USING MUSICAL STRUCTURES TO COMMUNICATE EMOTION."**

**CONDUCTED BY JACOBUS KRIGE OF**
**P.O.BOX 32268, PIONIERSPARK, NAMIBIA**
**Tel: +264 81 285 4585, jacuskrige@gmail.com**

# AURAL TEST FOR MUSIC AND EMOTION

Dear participant,

The test that you are about to participate in forms part of a research project from the University of Cape Town and is conducted by Jacus Krige of the College of the Arts in Windhoek. This is not to test your abilities to understand music, but will contribute to the research of the relationship between music and emotion.

In this test, you will listen to short pieces of music, where after you will be asked to choose words to describe the 'feeling' of each piece of music.

There are no costs or risks involved for taking part in this test; your only expense will be an hour of your time and some valuable answers! There will also be no payment for your participation.

You will need your own pencil and eraser to complete the test, as well as a pen to sign this consent form. If you do not have any of the above, it will be provided to you by the teacher.

It is important that you understand that you are under no obligation to take part in this test, and you are allowed to withdraw from this test at any time that you feel uncomfortable with the content thereof. However, this test should reveal an exciting way of thinking about music, and I firmly believe that you will enjoy this test.

Please sign your name at the bottom of this page to acknowledge that you did read and understand the information of this page, and that you are willing to participate in this test. This sheet will be taken in separately from your answer sheet, so no-one will know which answers are yours! The only information that we will need from you is your age, which you have to write down on your answer sheet.

If you have any further questions, please ask the teacher that is facilitating the test, else feel free to contact the study leader. If you are under 18, please take this form to your parent/guardian to be signed.

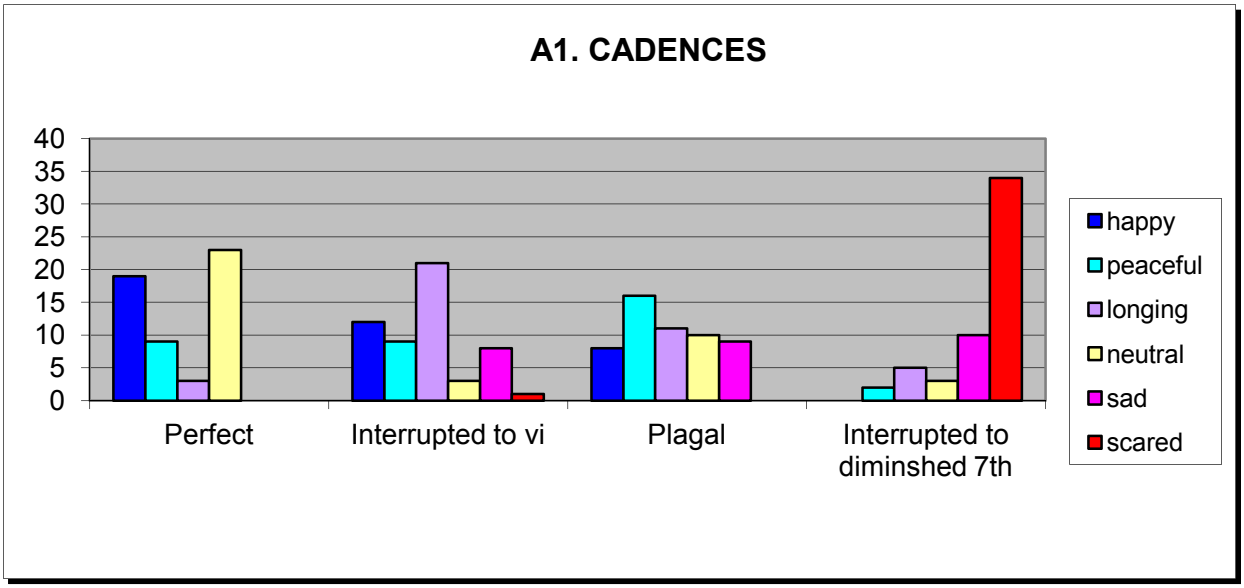
Yours sincerely,

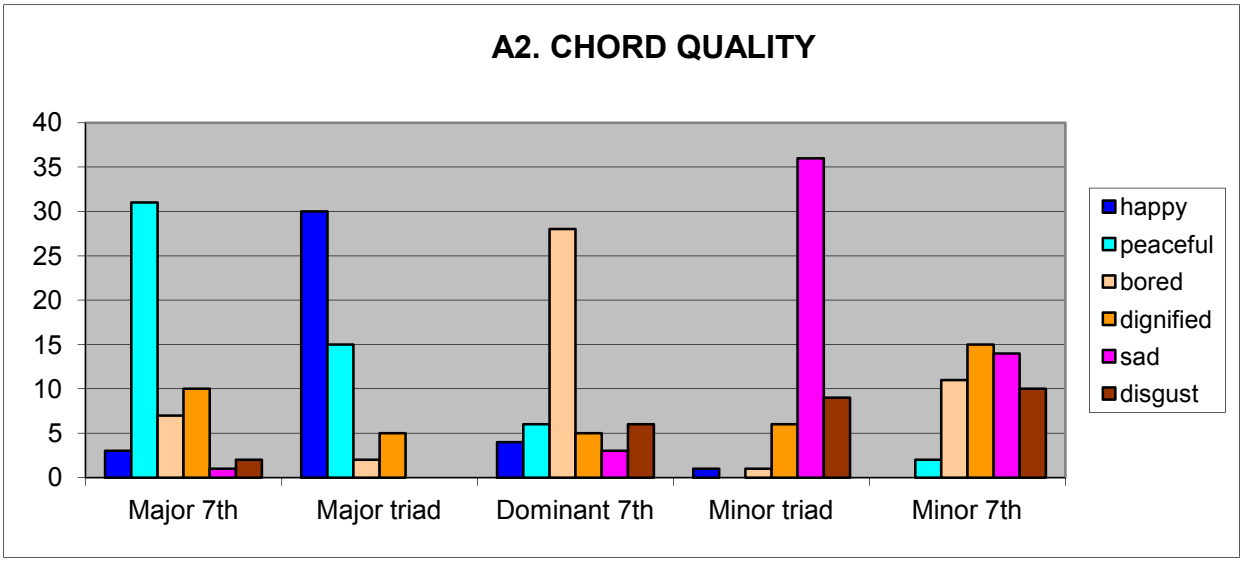
| | |
|---|---|
| _____ | _____ |
| Jacobus Krige<br>*Study leader* | Date |

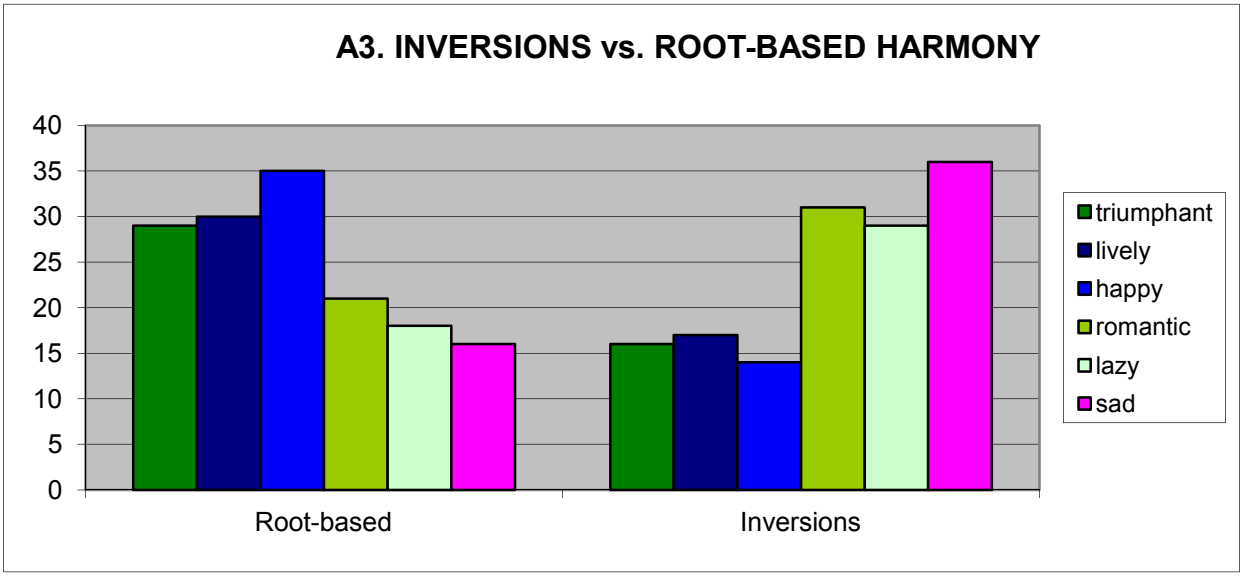
| | | |
|---|---|---|
| _____ | _____ | _____ |
| *Your name* | *Your signature* or *your parent/guardian's signature.* | *Today's date* |

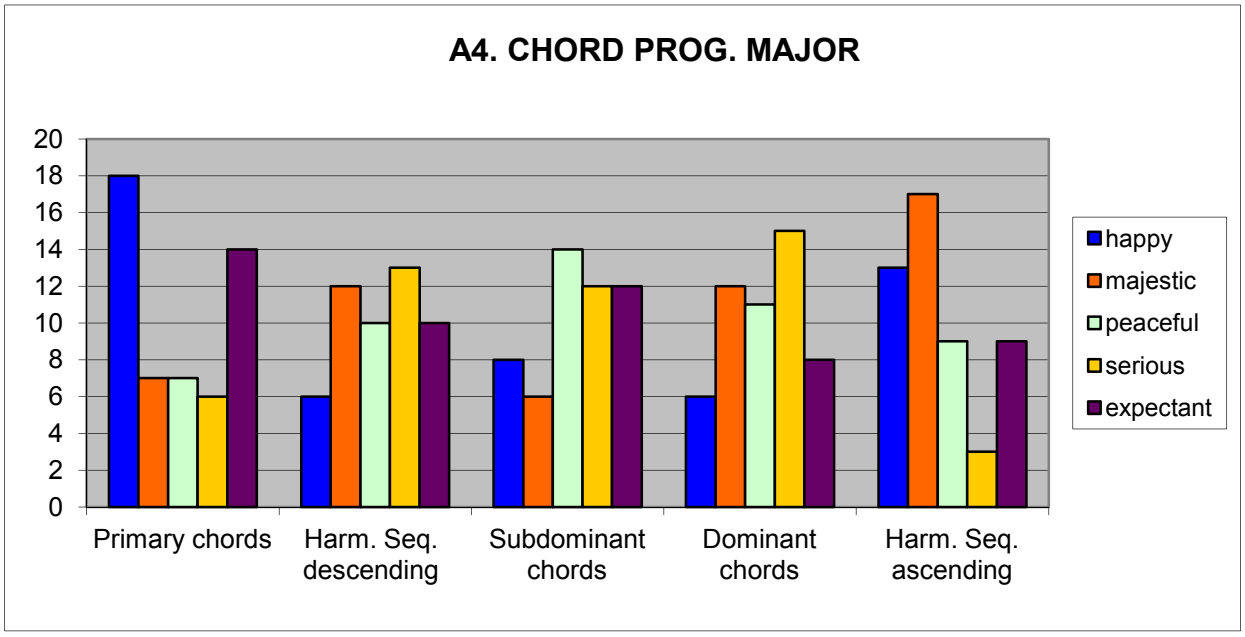
ANNEXURE 4

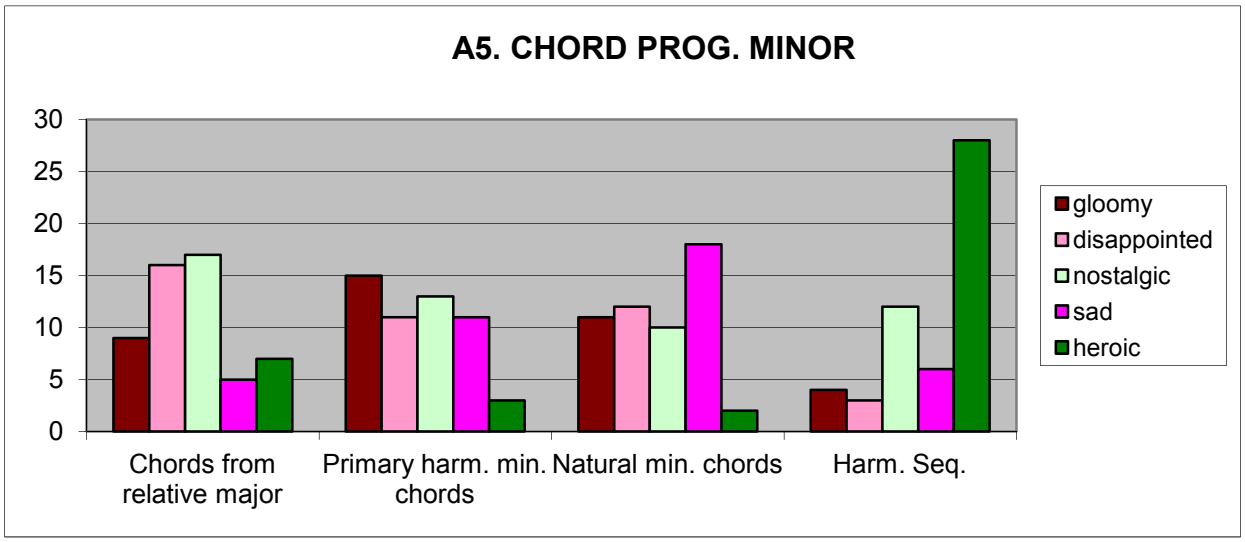
GRAPHS WITH RESULTS FROM EMPIRICAL TESTS

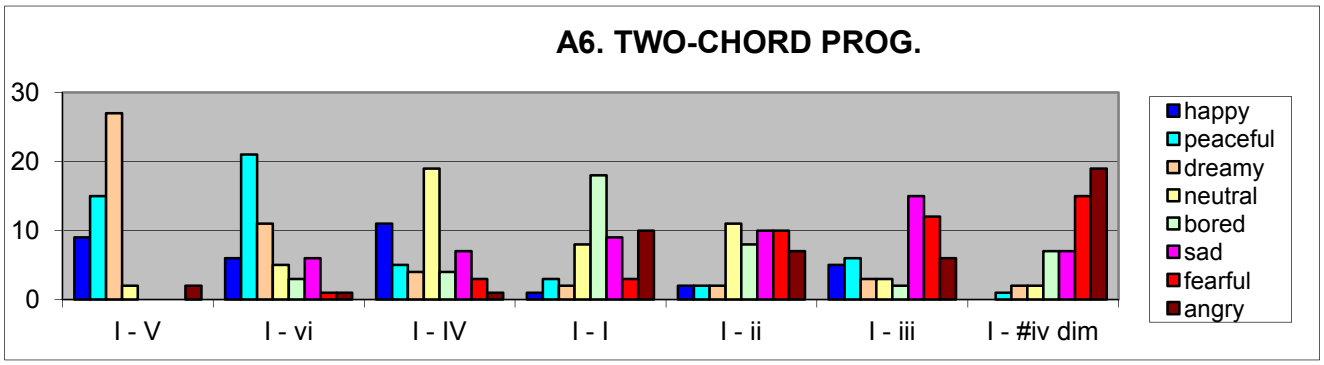


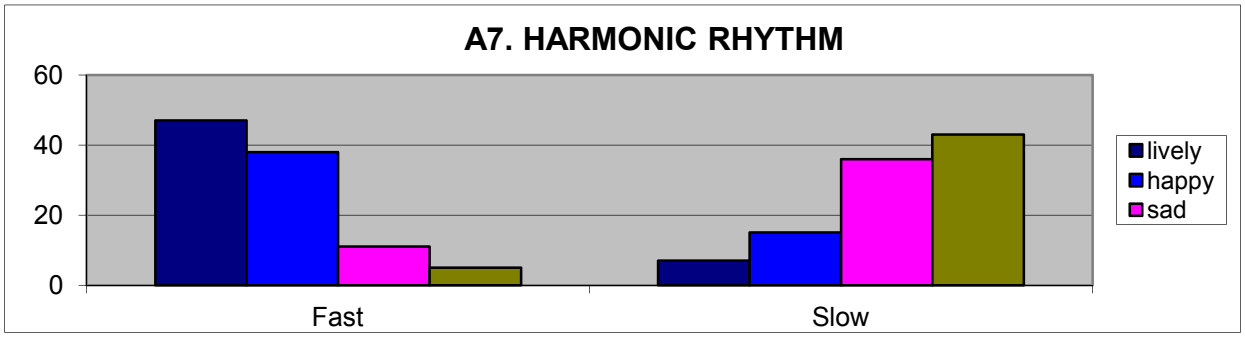



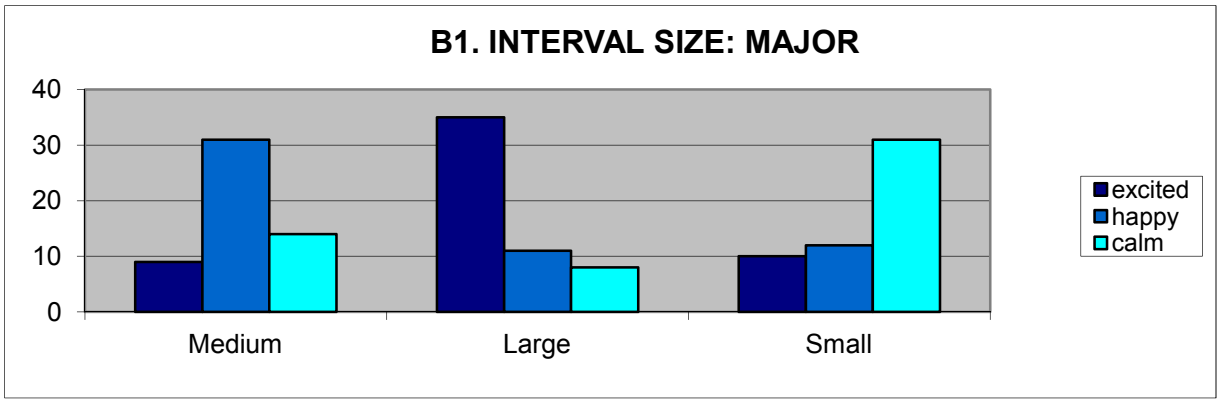



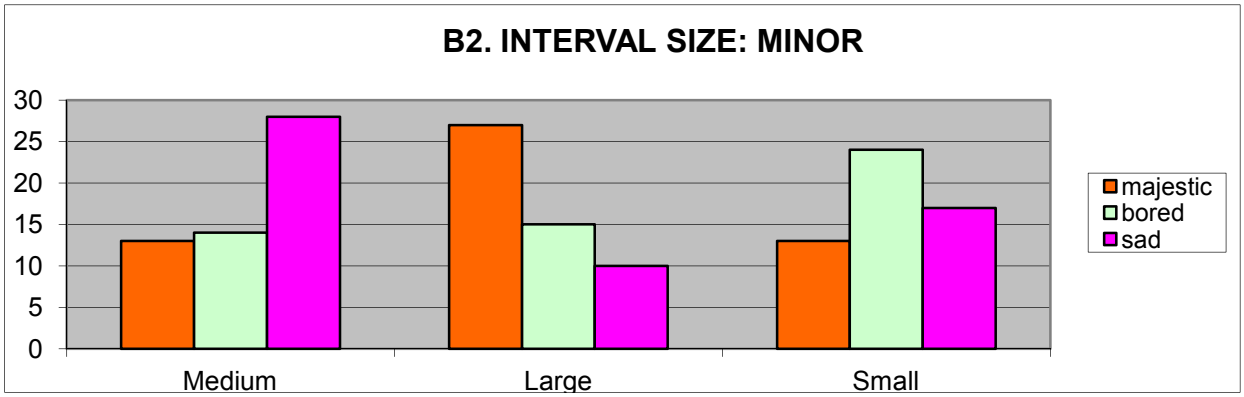

A4. CHORD PROG. MAJOR
20
18
16
14
12
10
8
6
4
2
0
Primary chords
Harm. Seq. descending
Subdominant chords
Dominant chords
Harm. Seq. ascending
happy
majestic
peaceful
serious
expectant

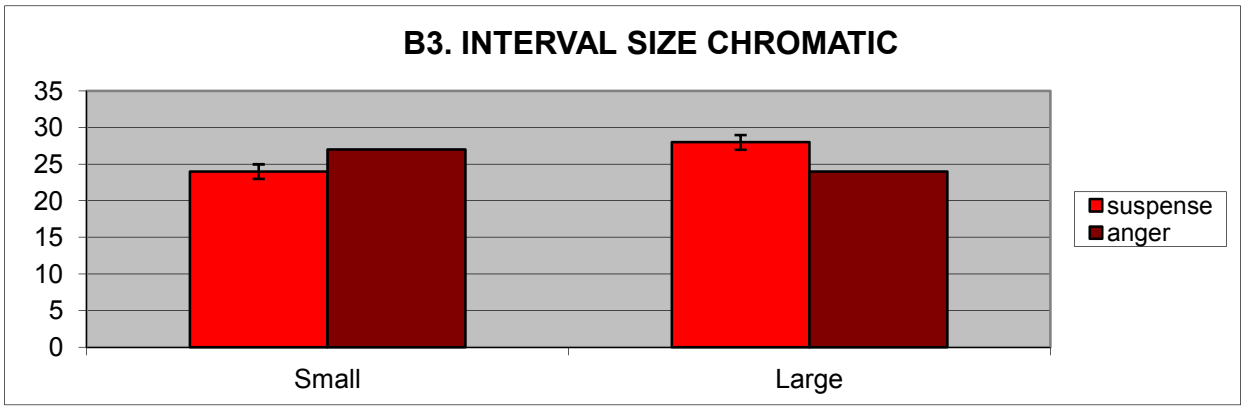

A5. CHORD PROG. MINOR
30
25
20
15
10
5
0
Chords from relative major
Primary harm. min. chords
Natural min. chords
Harm. Seq.
gloomy
disappointed
nostalgic
sad
heroic


A6. TWO-CHORD PROG.
30
20
10
0
I - V
I - vi
I - IV
I - I
I - ii
I - iii
I - #iv dim
happy
peaceful
dreamy
neutral
bored
sad
fearful
angry


A7. HARMONIC RHYTHM
60
40
20
0
Fast
Slow
lively
happy
sad

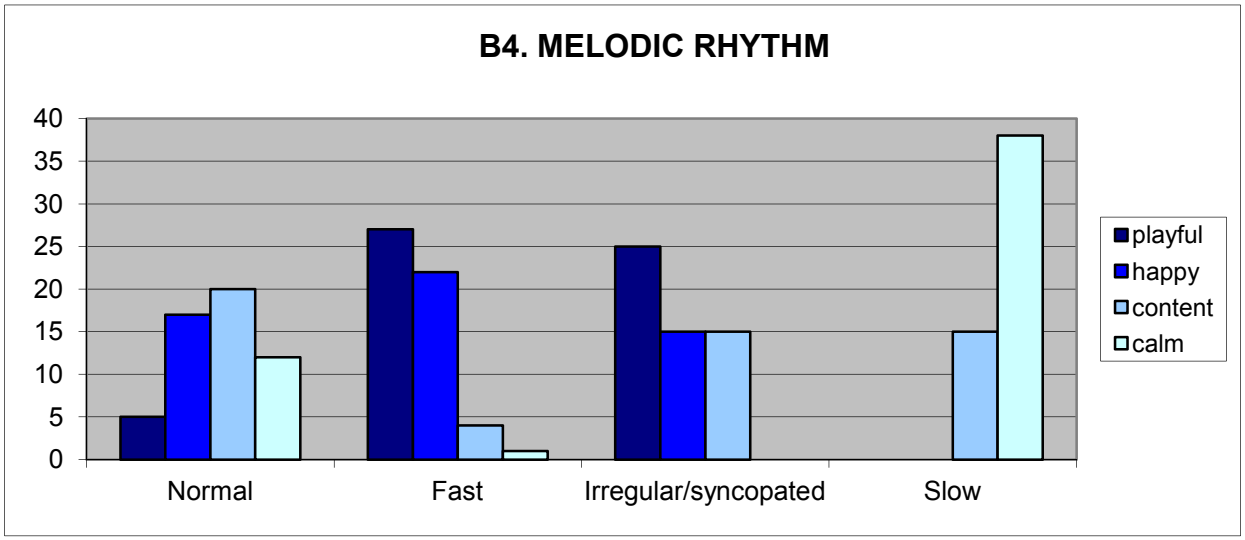

B1. INTERVAL SIZE: MAJOR
40
30
20
10
0
Medium
Large
Small
excited
happy
calm

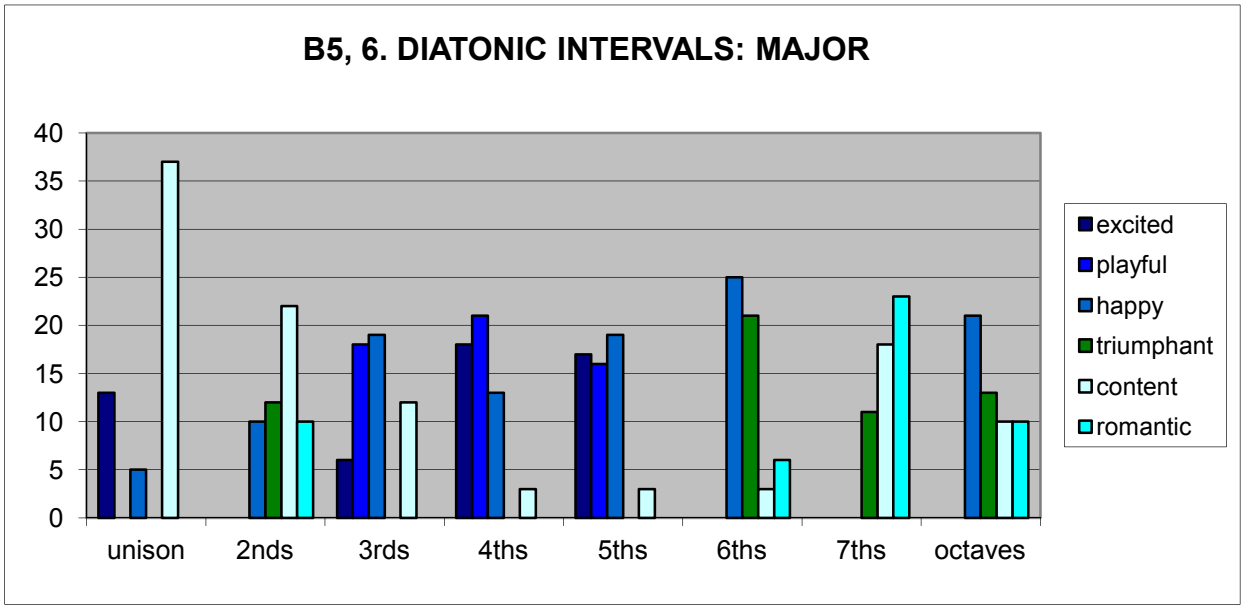

B2. INTERVAL SIZE: MINOR
30
25
20
15
10
5
0
Medium
Large
Small
majestic
bored
sad

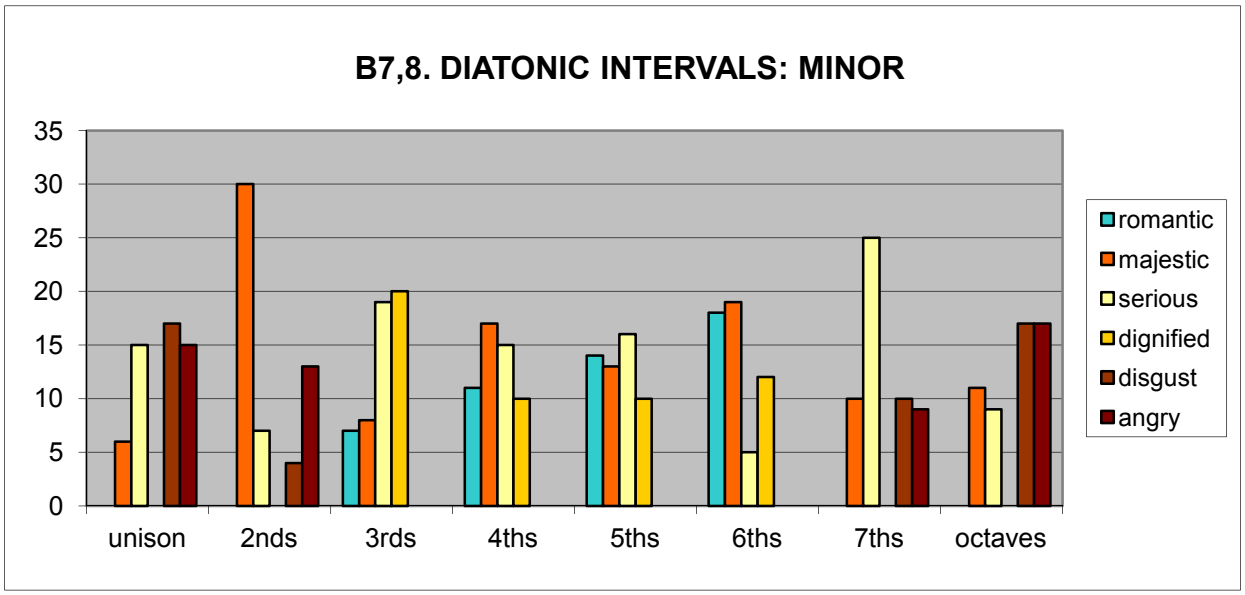

B3. INTERVAL SIZE CHROMATIC
35
30
25
20
15
10
5
0
Small
Large
suspense
anger



ANNEXURE 4

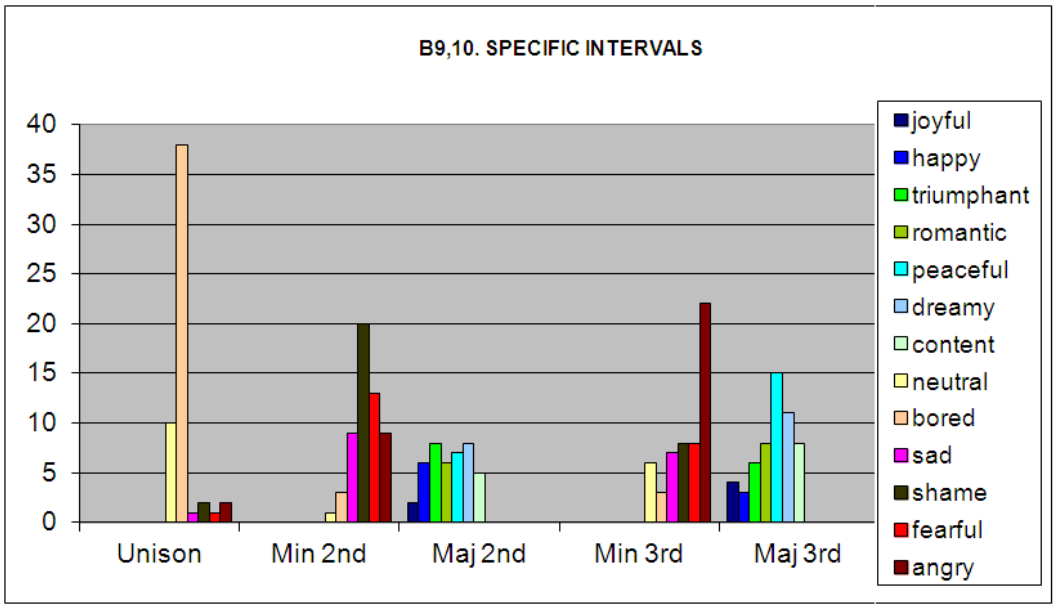

B4. MELODIC RHYTHM
40
35
30
25
20
15
10
5
0
Normal
Fast
Irregular/syncopated
Slow
playful
happy
content
calm

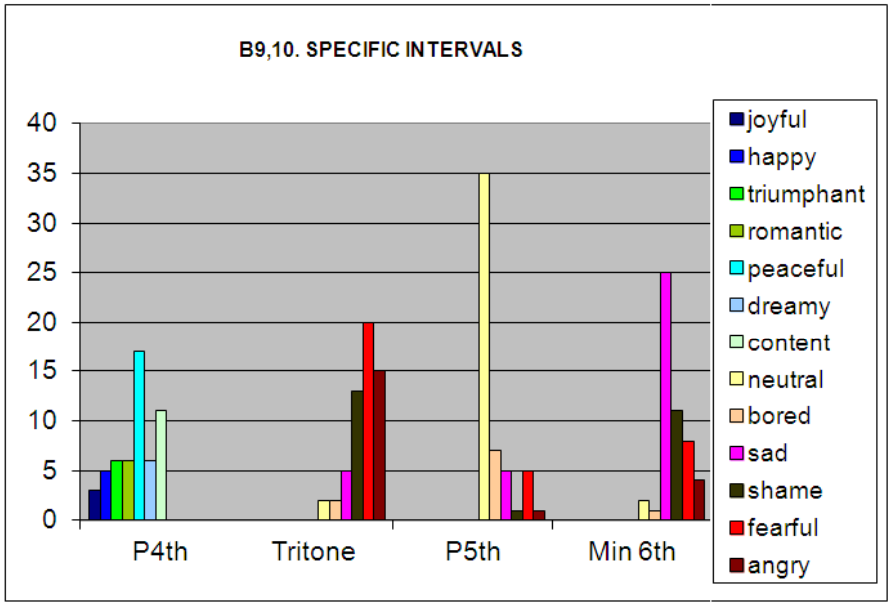

B5, 6. DIATONIC INTERVALS: MAJOR
40
35
30
25
20
15
10
5
0
unison
2nds
3rds
4ths
5ths
6ths
7ths
octaves
excited
playful
happy
triumphant
content
romantic

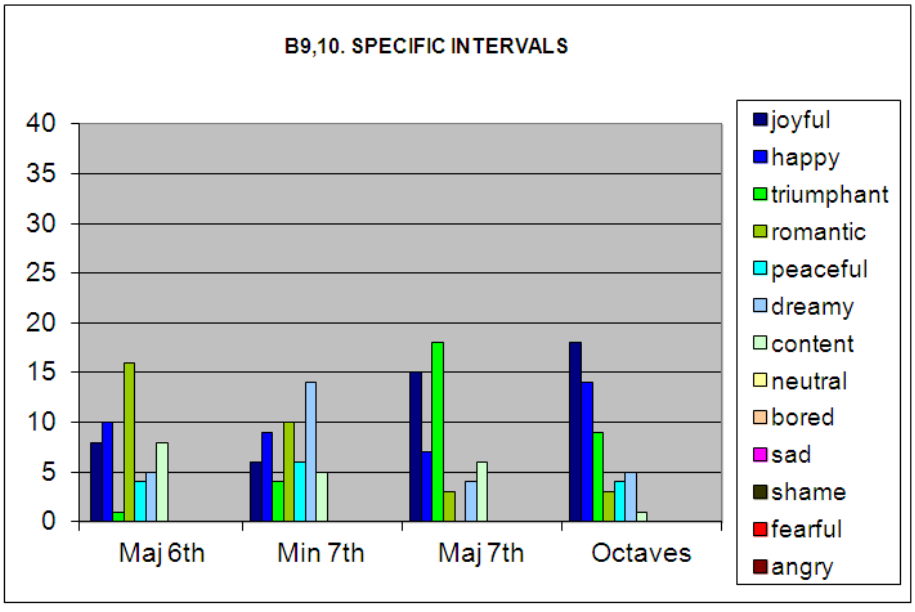

B7,8. DIATONIC INTERVALS: MINOR
35
30
25
20
15
10
5
0
unison
2nds
3rds
4ths
5ths
6ths
7ths
octaves
romantic
majestic
serious
dignified
disgust
angry



ANNEXURE 4

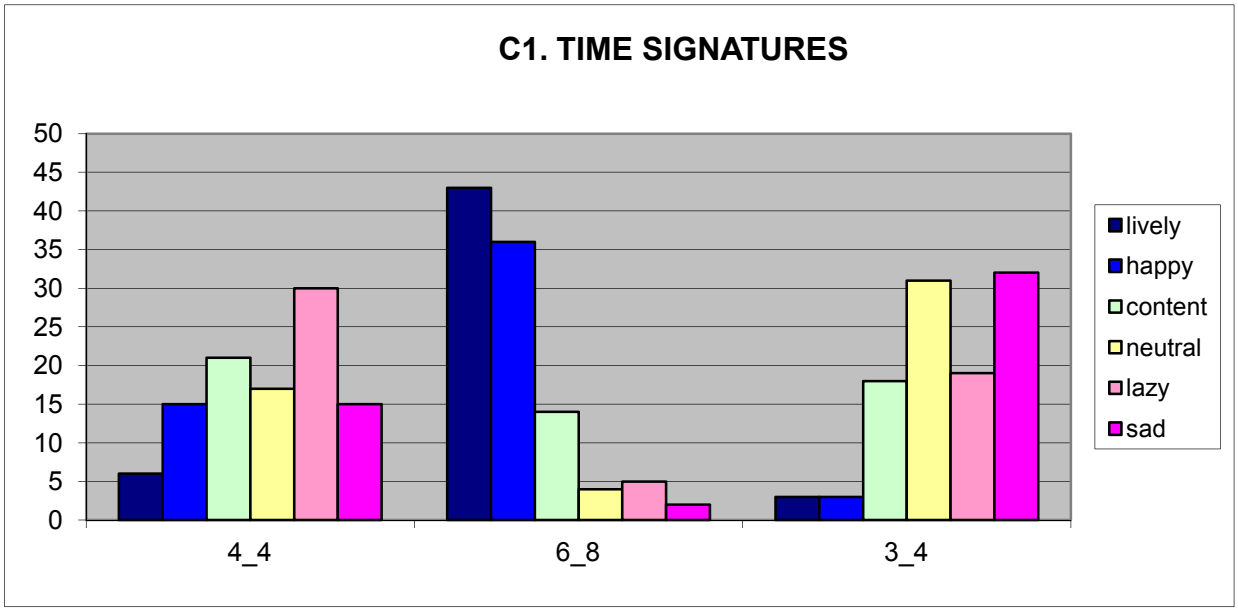

B9,10. SPECIFIC INTERVALS
40
35
30
25
20
15
10
5
0
Unison
Min 2nd
Maj 2nd
Min 3rd
Maj 3rd
joyful
happy
triumphant
romantic
peaceful
dreamy
content
neutral
bored
sad
shame
fearful
angry


B9,10. SPECIFIC INTERVALS
40
35
30
25
20
15
10
5
0
P4th
Tritone
P5th
Min 6th
joyful
happy
triumphant
romantic
peaceful
dreamy
content
neutral
bored
sad
shame
fearful
angry


B9,10. SPECIFIC INTERVALS
40
35
30
25
20
15
10
5
0
Maj 6th
Min 7th
Maj 7th
Octaves
joyful
happy
triumphant
romantic
peaceful
dreamy
content
neutral
bored
sad
shame
fearful
angry



ANNEXURE 4

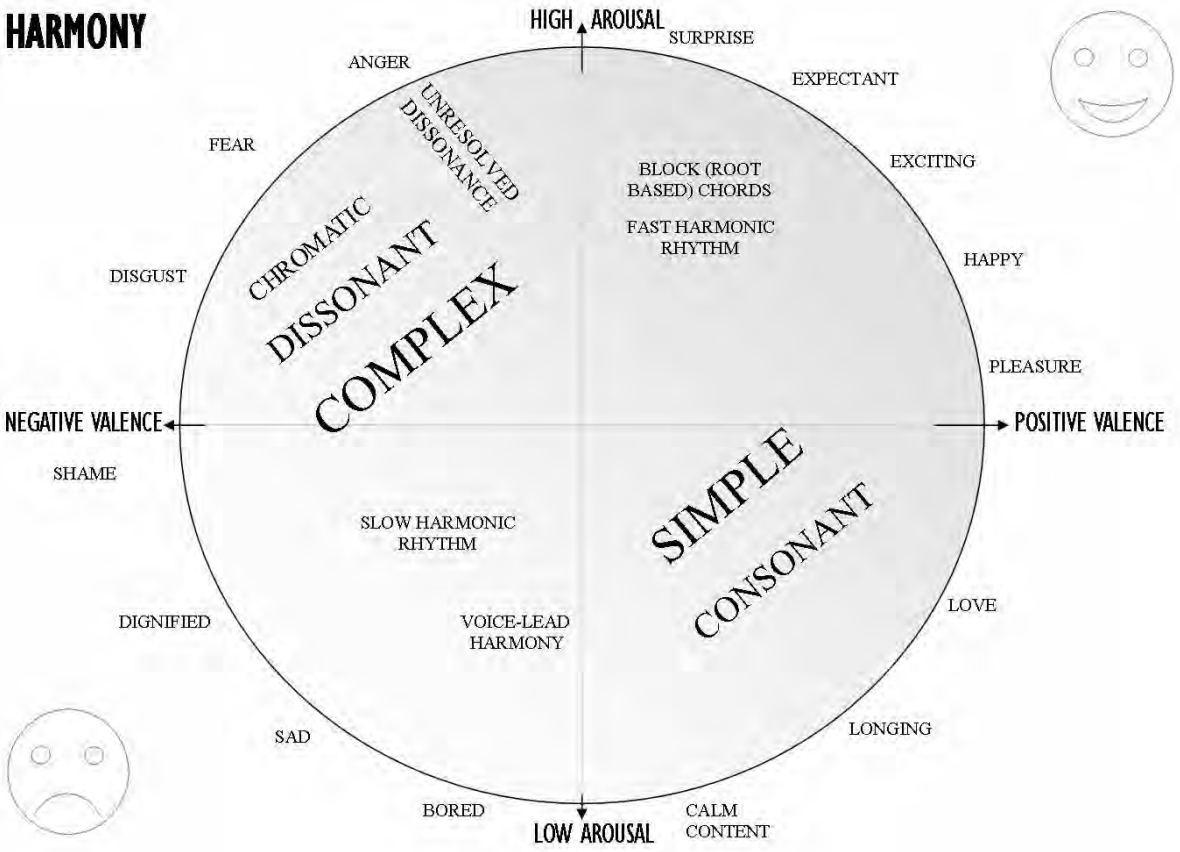

C1. TIME SIGNATURES
50
45
40
35
30
25
20
15
10
5
0
4_4
6_8
3_4
lively
happy
content
neutral
lazy
sad

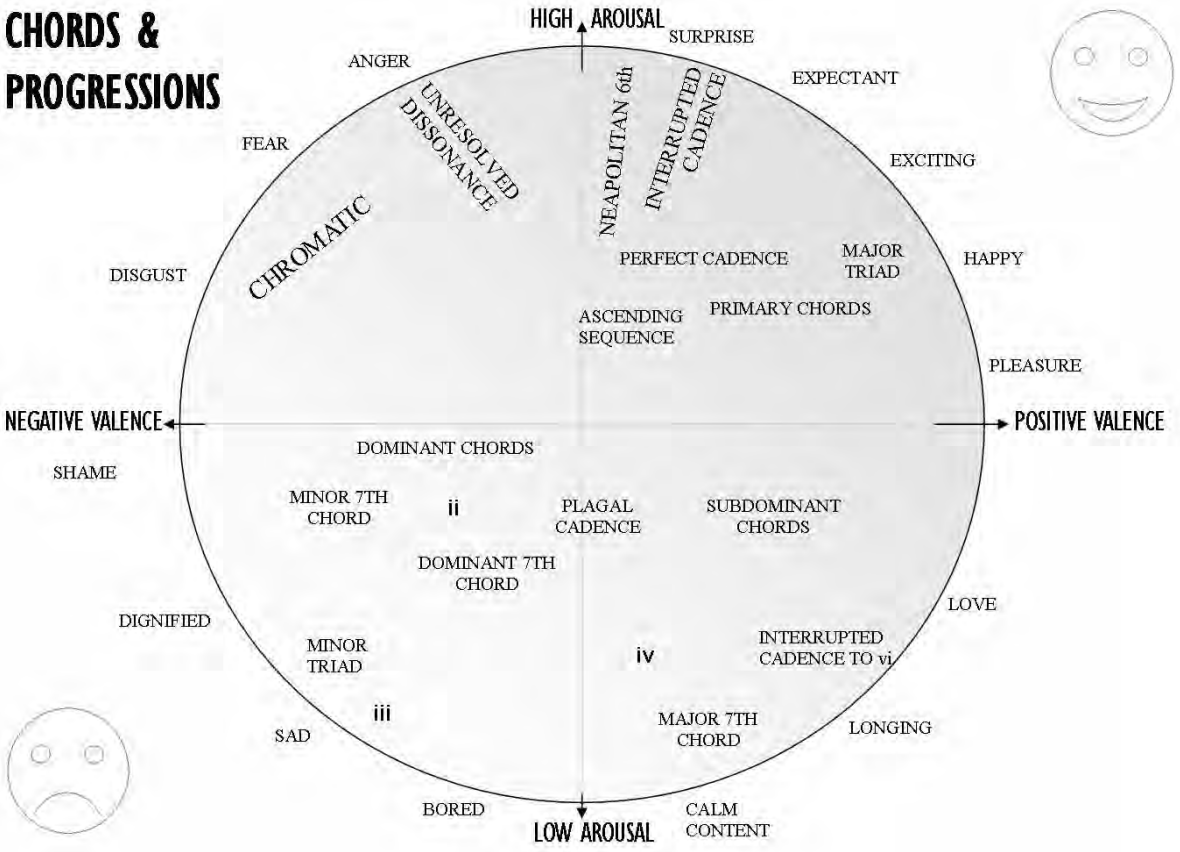


ANNEXURE 4

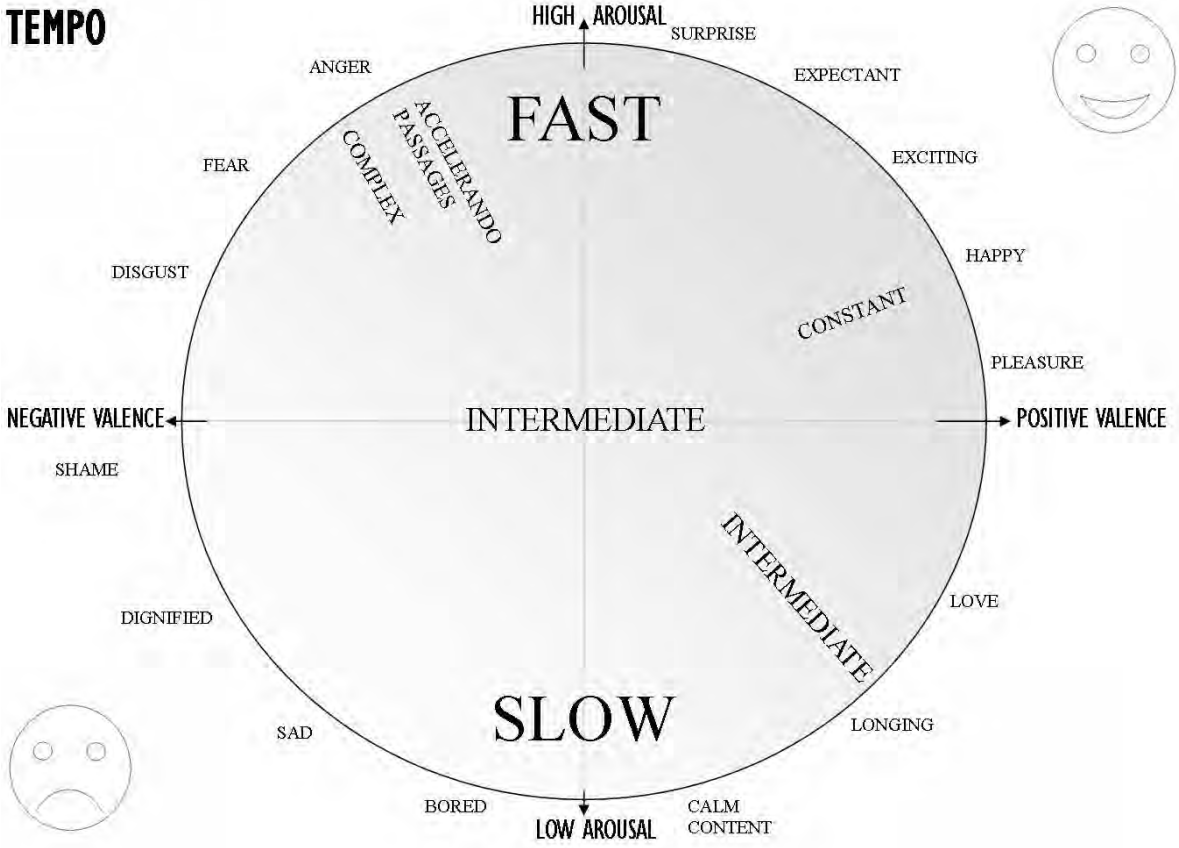
ANNEXURE 5

GRAPHICAL SUMMARIES OF MUSICAL STRUCTURES AND EMOTIONS

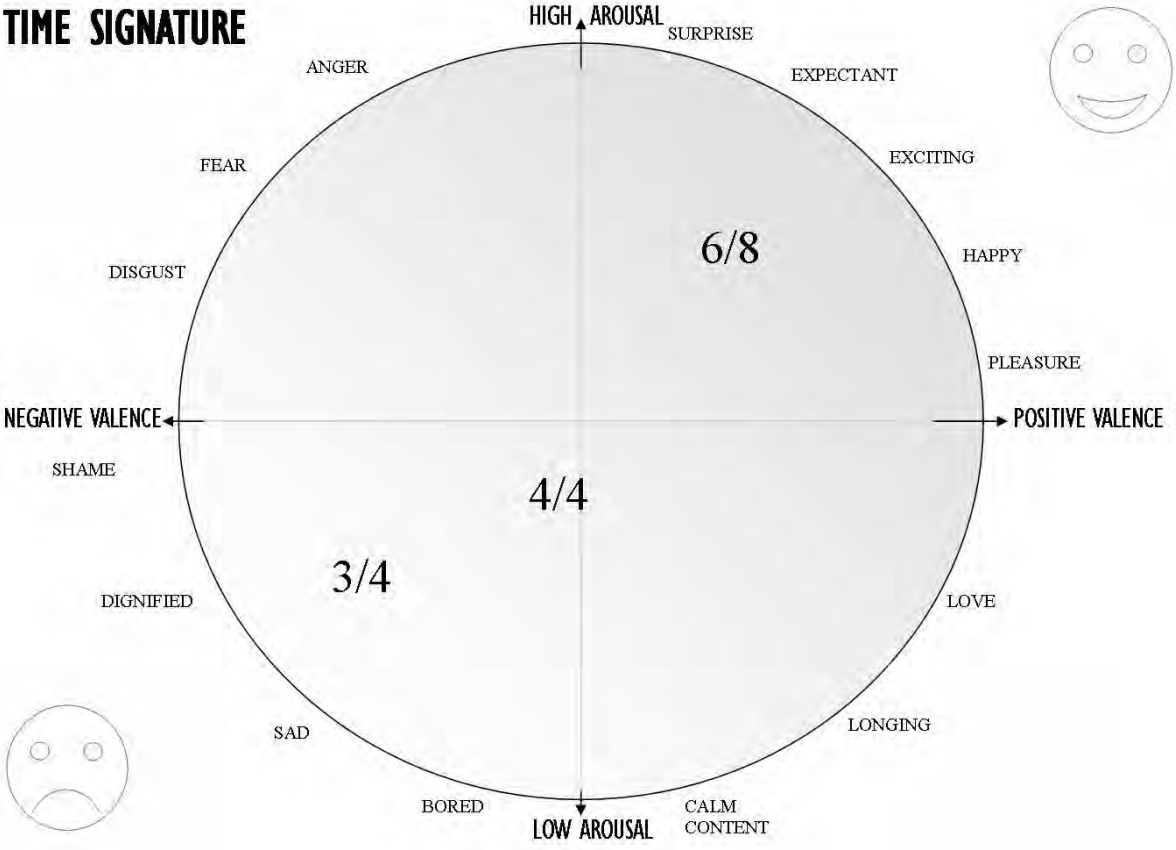


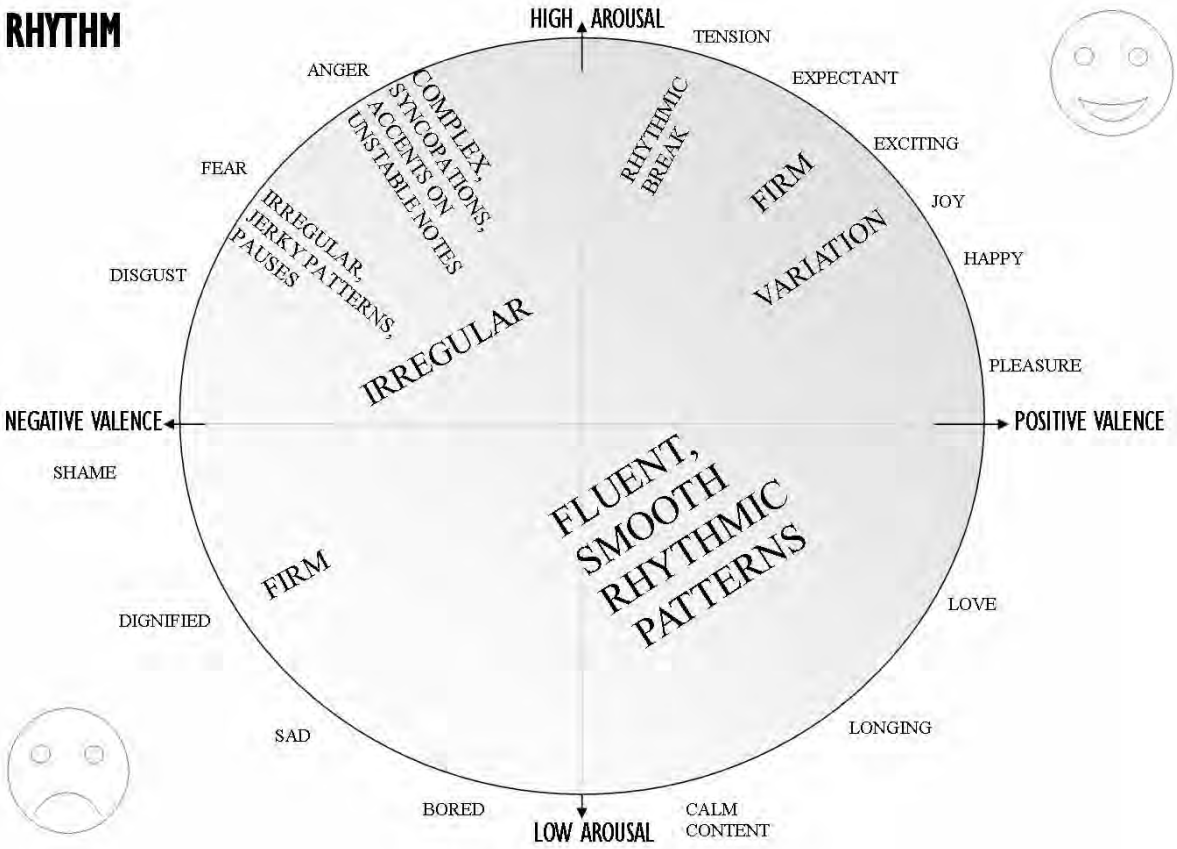



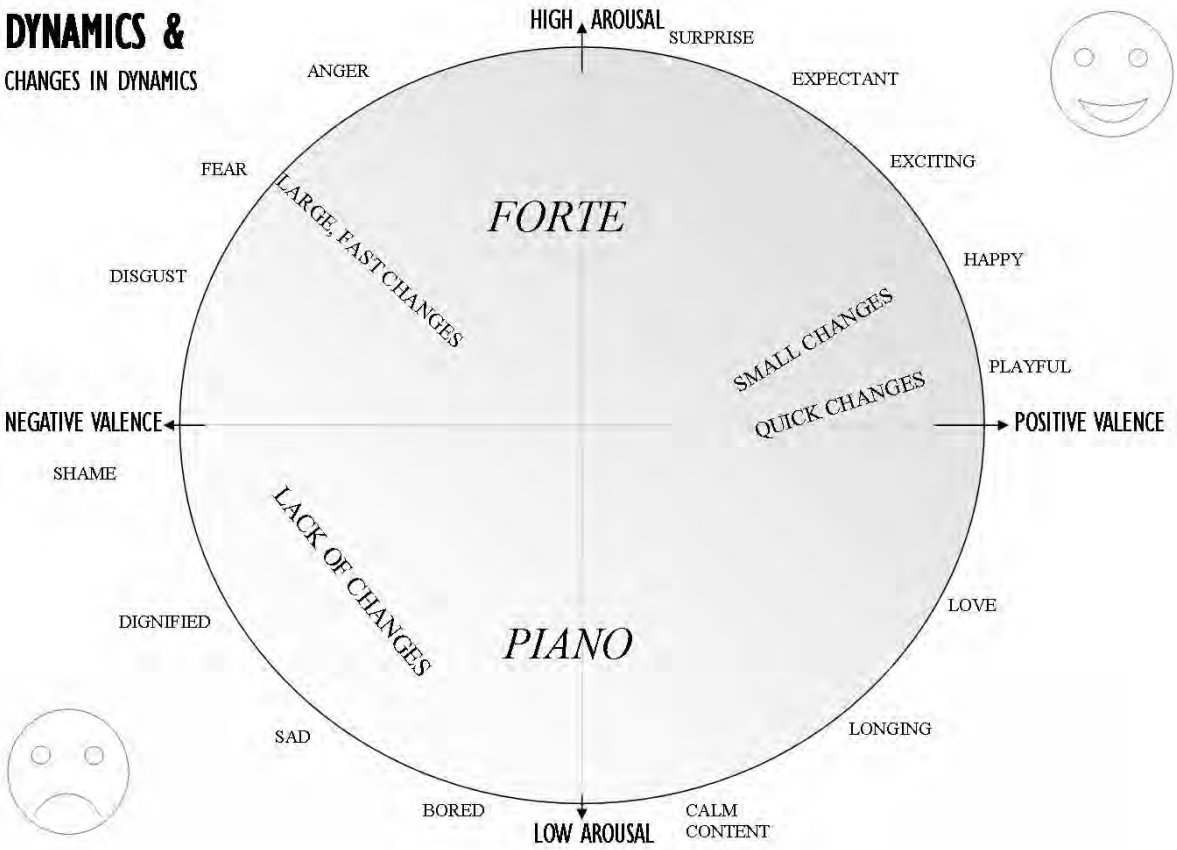
## TEMPO



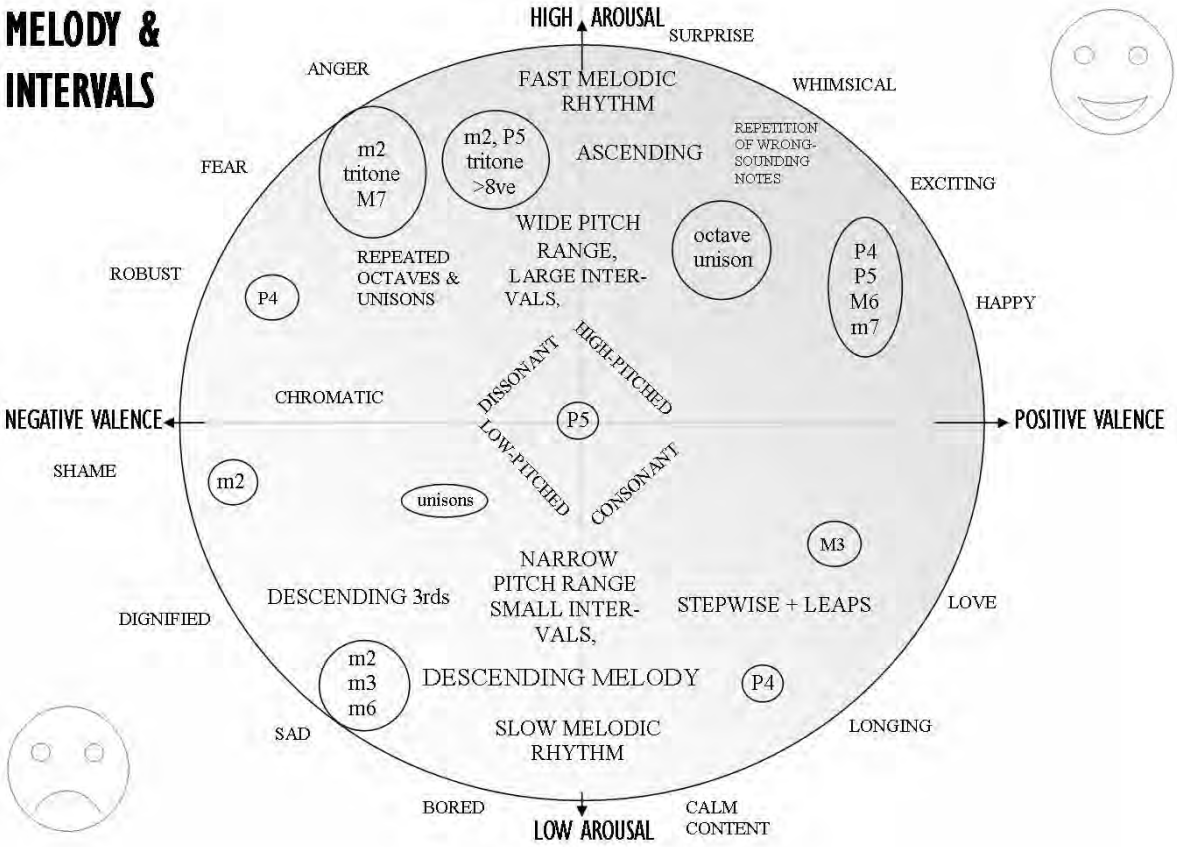

## TIME SIGNATURE



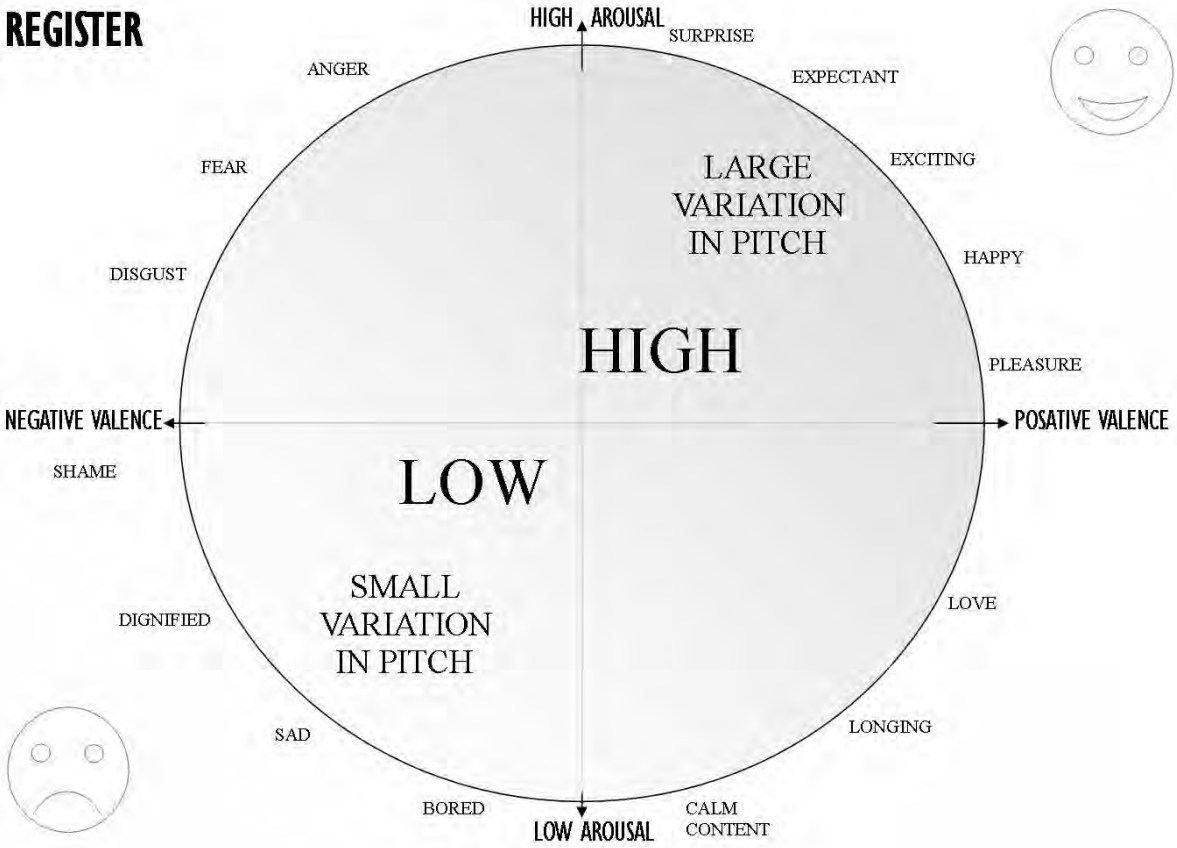

RHYTHM
HIGH AROUSAL
TENSION
EXPECTANT
EXCITING
JOY
HAPPY
PLEASURE
LOVE
LONGING
CALM
CONTENT
LOW AROUSAL
BORED
SAD
DIGNIFIED
SHAME
NEGATIVE VALENCE
POSITIVE VALENCE
DISGUST
FEAR
ANGER
COMPLEX, SYNCOPATIONS, ACCENTS ON UNSTABLE NOTES
RHYTHMIC BREAK
FIRM
VARIATION
IRREGULAR, JERKY PATTERNS, PAUSES
IRREGULAR
FLUENT, SMOOTH RHYTHMIC PATTERNS
FIRM


DYNAMICS &
CHANGES IN DYNAMICS
HIGH AROUSAL
SURPRISE
EXPECTANT
EXCITING
HAPPY
PLAYFUL
LOVE
LONGING
CALM
CONTENT
LOW AROUSAL
BORED
SAD
DIGNIFIED
SHAME
NEGATIVE VALENCE
POSITIVE VALENCE
DISGUST
FEAR
ANGER
FORTE
LARGE, FAST CHANGES
SMALL CHANGES
QUICK CHANGES
LACK OF CHANGES
PIANO

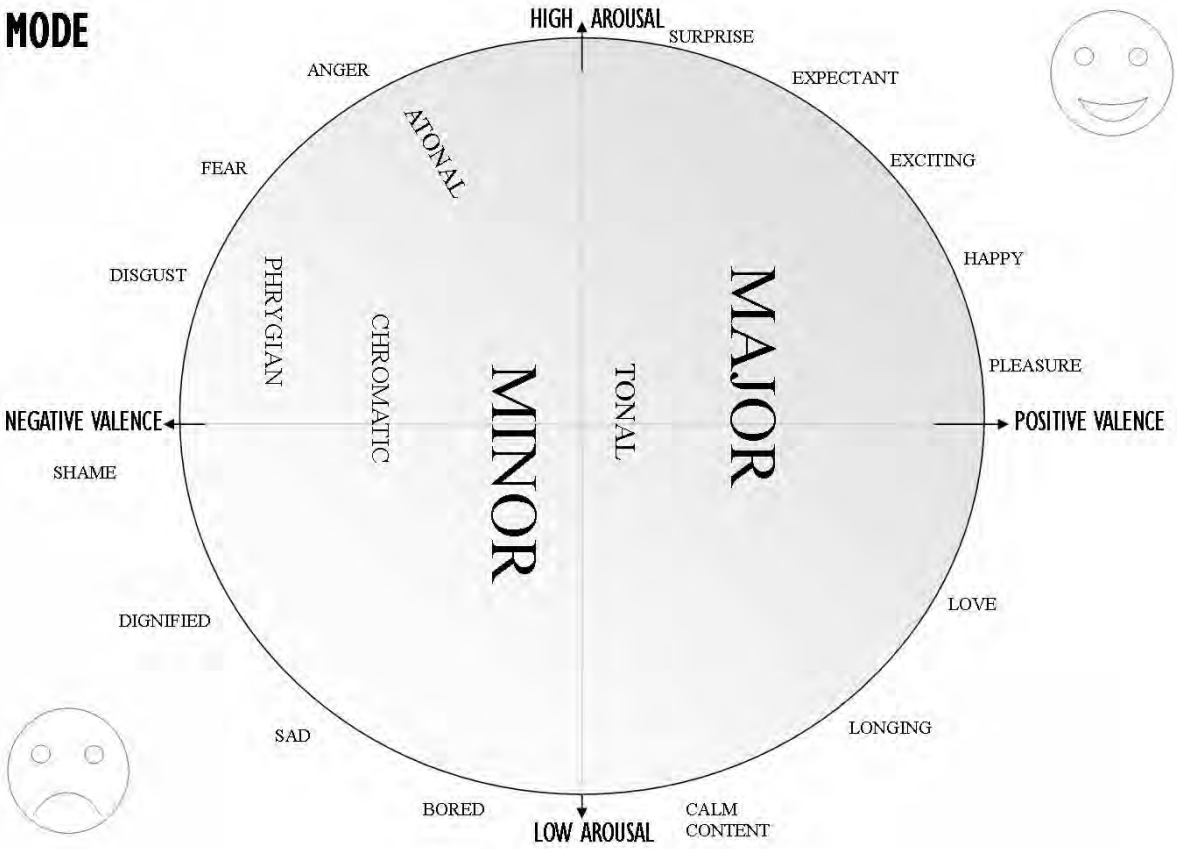
## MELODY & INTERVALS




## REGISTER



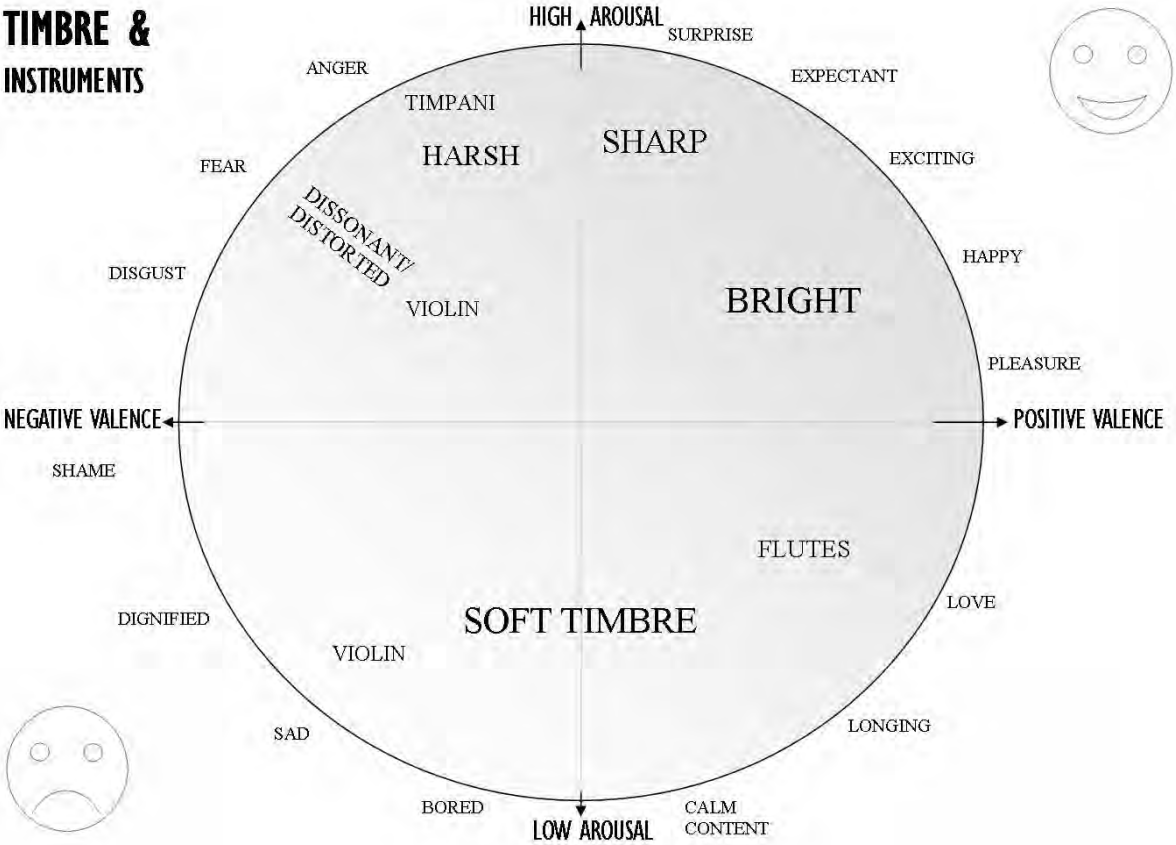
## MODE




## TIMING & PERFORMANCE FEATURES:

VIBRATO, INTONATION, ARTICULATION, RHYTHMIC & TIMING CONTRASTS & VARIABILITY

## TIMBRE & INSTRUMENTS




## COMPLEXITY